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NOTTAWASAGA VALLEY CONSERVATION REPORT

WATER



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MINISTRY OF NATURAL RESOURCES

Hon. Leo Bernier, Minister

W. Q. Macnee, Deputy Minister

N. D. Patrick, Director, Conservation Authorities Branch

NOTTAWASAGA
VALLEY
CONSERVATION
REPORT
WATER

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AUTHORSHIP

The following report was prepared by L.J. Balogh, project technician, engineering staff, under the overall supervision of J.W. Murray and T.M. Kurtz, Chief Engineer and Assistant Chief Engineer respectively, of the Conservation Authorities Branch. General editing was by M.B. Addinall and preparation of maps, illustrations and graphs for printing was under the supervision of W.J. Clark, Supervisor of Draughtsmen with the Conservation Authorities Branch.

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INTRODUCTION

The Nottawasaga Valley Conservation Authority was established by Order-in-Council No. 1837 on May 5th, 1960, in accordance with the provisions of The Conservation Authorities Act of 1946. In 1964, a conservation report covering the management of the land, forest, recreation and wildlife resources within the area under jurisdiction of the Authority was prepared and published by the Conservation Authorities Branch. This report did not deal with the water resources of the area.

At the annual meeting of the Authority held on March 27, 1968, Resolution No. 16 was passed to "complete the water section of the Conservation Report". Following this resolution, a formal request was forwarded to the Conservation Authorities Branch on October 21st, 1969.

On December 17th, 1970, the executive committee of the Authority further requested a ten year conservation plan for the 1970's.

This report is the result of field surveys conducted by the Conservation Authorities Branch in the summers of 1971 and 1972. It includes an inventory of the surface water resources, examination of their development potential and existing and possible future problems, and recommendations for applicable remedial measures. Other general recommendations are also made for the management of the waters as a renewable resource.

For overall details of the study area, reference should be made to the Nottawasaga Valley Conservation Report published in 1964.

Acknowledgements

Appreciation is expressed for the assistance received during the survey and preparation of this report from members of the Nottawasaga Valley Conservation Authority, other residents of the region, staff members of the former Ontario Department of Lands and Forests and the Ontario Ministry of the Environment, members of the staff of the Georgian College of Applied Arts and Technology at Barrie, and officers and men of the Canadian Forces Base at Borden.

Especial acknowledgement is made of the contributions of Major Pineau, Captain Scavuggo and Corporal Horne, and Messrs A. Grant, P. Harvie, W. McNeice and R. Vatcher.

N.D. Patrick, Director
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Chapter 1

THE NOTTAWASAGA WATERSHED AND AREA

1. Location

The Nottawasaga Watershed lies within the counties of Simcoe, Dufferin and Grey; 74 per cent is in Simcoe, 22 per cent in Dufferin and 4 per cent in Grey. The watershed is roughly rectangular in shape. Its north-south dimension averages 38 miles and the east-west width 31.5 miles; the total area measures 1310 square miles. The map of the area is shown on Figure 1-1.

The watershed is bounded on the north by the shoreline of Nottawasaga Bay (an arm of Georgian Bay) and the watersheds of the streams flowing directly into Georgian Bay. On the east the watershed is bounded by the drainage areas of the numerous small streams flowing directly into Lake Simcoe including the Holland River Watershed. The Humber and Credit River Watersheds form the southern boundary, while on the west lie the Grand, Saugeen and Beaver Rivers.

The areas of 28 municipalities are wholly or partly within the jurisdiction of the Nottawasaga Valley Conservation Authority. These are:

The City of Barrie

The Towns of

Alliston

Collingwood

Stayner

The Villages of

Beeton

Cookstown

Creemore

Shelburne

Tottenham

Wasaga Beach

The Townships of

Adjala

Amaranth

Collingwood

Essa

Flos

Gwillimbury West

Innisfil

Medonte

Melancthon

Mono

Mulmur

Nottawasaga

Oro

Osprey

Sunnidale

Tecumseth

Tosorontio

Vespra

In addition to these incorporated municipalities are the Police Villages of Angus, Everett, Hornings Mills, Nottawa, Thornton, and many unincorporated hamlets scattered throughout the watershed.

The city of Barrie, on the easterly boundary of the watershed (only 10 per cent of the corporation lies within the Authority area) is the main urban focus for the easterly part of Simcoe County and the watershed. Collingwood, in the north-west corner of the watershed, and Orangeville (which lies in the Credit Watershed) are smaller trading centres. The whole watershed is influenced in many ways by the proximity of Metropolitan Toronto, the northern boundary of which lies less than 20 miles from the southern part of the watershed.

The watershed is well served by highways, with 400, 11 and 27 from Toronto passing through Barrie and continuing to points north. Highways 26 and 89 serve the watershed in an east-west direction and 24 runs north-south through the western part of the watershed. Several rail lines, including the transcontinental Canadian National and Canadian Pacific, cross the watershed. All portions of the area are well served by a grid of county and township roads.

While not a municipality or political unit, the Camp Borden military establishment is an important unit in the watershed. Nearly 36 square miles in area, it is located astride the townships of Tosorontio and Essa and almost exactly in the centre of the Nottawasaga drainage area.

2. Climate

Climate is the sum of past weather experiences. The conditions of temperature, moisture and light tend to be repeated seasonally since, for the most part, they are controlled by the sun, seas and land contours. Local climate, however, may be profoundly affected by the proximity of water and local topographic relief.

Such is the case in the Nottawasaga watershed where Georgian Bay and the Niagara escarpment combine to give considerable climatic variations over relatively short distances.

In Table 1-1, which lists the annual values of temperature and precipitation for four widely separated stations, the temperature-moderating effect of Georgian Bay is apparent in the average number of days with frost — 149 at Collingwood and 181 at Redickville. Also noticeable is the snowbelt area of the northern part of the watershed, with Collingwood, Angus and Redickville having annual amounts over 90 inches, while Beeton records only 73 inches. The three accompanying figures, 1-2, 1-3 and 1-4, show the seasonal progression of temperature and precipitation on the watershed.

While annual values of rainfall show some variation from station to station, this is not indicative of similar variations in rainfall intensity. Localized intense summer thunderstorms are a common occurrence in all sections of the watershed and are capable of causing floods, particularly on the small streams, in a very short space of time. The highest values for maximum precipitation in 24 hours were 4.0 and 4.8 inches in the month of October at Angus and Beeton, and 5.0 inches in the month of July at Collingwood.

The period of the spring freshet is normally in late March or early April. However, the climatic variations on this watershed are such that high flows caused by snowmelt and rainfall can occur in any of the winter months.

The Conservation Authority ranks 9th in size among the 37 Conservation Authorities in Ontario and 19th in terms of population, with 64,759 permanent residents according to the latest 1972 figures. However, with the Wasaga Beach area within its jurisdiction, this figure is probably at least doubled in the summer vacation period.

The permanent population is predominantly rural, with approximately 61 per cent in this category, and 39 per cent classified as urban.

TABLE 1 - 1
TEMPERATURE AND PRECIPITATION SUMMARY*
30 YEAR NORMALS (1941 - 1970)

	Redickville	Angus	Beeton	Collingwood
Weather station elevation — feet above sea level	1715	627	764	600
Average annual number of days with frost	181	171	162	149
Average annual number of days with precipitation	126	140	112	111
Extreme maximum temperature/no. years of record	93°F/23	100°F/29	104°F/50	104°F/50
Extreme minimum temperature/no. years of record	-27°F/23	-42°F/29	-33°F/50	-32°F/50
Mean annual maximum temperature	49.8°F	54.4°F	54.0°F	52.9°F
Mean annual minimum temperature	31.9°F	33.0°F	34.2°F	36.4°F
Mean annual temperature	40.9°F	43.7°F	44.1°F	44.7°F
Average annual rainfall — inches	25.98	23.14	24.13	21.15
Average annual snowfall — inches	94.0	94.7	73.3	96.9
Average annual precipitation — inches	35.38	32.63	31.44	30.93

*Atmospheric Environment Service — Department of the Environment — Canada, Downsview, Ontario
UDC: 551.582 (713)

TABLE 1 - 2
GRADIENT OF PRINCIPAL STREAMS
OF THE
NOTTAWASAGA VALLEY CONSERVATION AUTHORITY

Stream	River Mileage		Distance in Miles	Difference of Elevation in Feet	Gradient Feet per Mile
	From	To			
Bailey Creek	0.00	0.80	0.80	10.0	12.50
	0.80	5.85	5.05	25.0	4.95
	5.85	9.10	3.25	27.5	8.46
	9.10	13.85	4.75	125.0	26.31
	13.85	18.10	4.25	372.5	87.64
Batteaux River	0.00	2.00	2.00	90.0	45.00
	2.00	5.40	3.40	80.0	23.52
	5.40	8.70	3.30	125.0	37.88
	8.70	11.00	2.30	350.0	152.17
	11.00	12.40	1.40	300.0	214.28
Bear Creek	0.00	4.60	4.60	100.0	21.73
	4.60	10.00	5.40	80.0	14.80
	10.00	11.00	1.00	150.0	150.00
Beeton Creek	0.00	8.30	8.30	95.0	11.44
	8.30	12.35	4.05	102.5	25.30
	12.35	13.00	0.65	73.0	112.30
Boyne River	0.00	5.50	5.50	60.0	10.90
	5.50	10.60	5.10	140.0	27.45
	10.60	16.60	6.00	350.0	58.33
	16.60	25.50	8.90	400.0	44.94
	25.50	29.40	3.90	60.0	15.38
Coates Creek	0.00	5.60	5.60	75.0	13.39
	5.60	10.80	5.20	125.0	24.03
	10.80	13.60	2.80	475.0	169.64
Innisfil Creek	0.00	6.50	6.50	25.0	3.85
	6.50	8.20	1.70	25.0	14.70
	8.20	12.00	3.80	25.0	6.58
	12.00	14.75	2.75	25.0	9.09
	14.75	17.20	2.45	175.0	71.42
	17.20	18.75	1.55	20.0	12.90
Mad River	0.00	13.40	13.40	60.0	4.47
	13.40	20.80	7.40	130.0	17.57
	20.80	30.60	9.80	520.0	53.06
	30.60	31.60	1.00	300.0	300.00
	31.60	45.00	13.40	130.0	9.70

**TABLE 1 - 2 – GRADIENT OF PRINCIPAL STREAMS OF THE
NOTTAWASAGA VALLEY CONSERVATION AUTHORITY – *Continued***

Stream	River Mileage		Distance in Miles	Difference of Elevation in Feet	Gradient Feet per Mile
	From	To			
Noisy River	0.00	3.60	3.60	230.0	63.88
	3.60	5.80	2.20	380.0	172.72
	5.80	10.80	5.00	140.0	28.00
Nottawasaga River	0.00	32.00	32.00	20.0	0.625
	32.00	49.20	17.20	70.0	4.06
	49.20	60.00	10.80	160.0	14.81
	60.00	66.30	6.30	190.0	30.16
	66.30	69.60	3.30	200.0	60.61
	69.60	72.30	2.70	270.0	100.00
Pennville Creek	72.30	75.60	3.30	85.0	25.75
Pine River	0.00	5.20	5.20	60.0	11.50
	5.20	8.70	3.50	55.0	15.70
Pine River	0.00	9.50	9.50	75.0	7.89
	9.50	13.50	4.00	100.0	25.00
	13.50	24.00	10.50	225.0	21.42
	24.00	26.40	2.40	200.0	83.33
	26.40	31.80	5.40	470.0	87.03
	31.80	34.30	2.50	30.0	12.00
Pretty River	0.00	4.95	4.95	140.0	28.28
	4.95	8.20	3.25	180.0	55.38
	8.20	9.75	1.55	170.0	109.67
	9.75	10.45	0.70	280.0	400.00
	10.45	11.60	1.15	220.0	191.30
Sheldon Creek	0.00	2.70	2.70	40.0	14.81
	2.70	5.30	2.60	125.0	48.07
	5.30	7.50	2.20	250.0	113.63
	7.50	12.10	4.60	400.0	86.95
Silver Creek	0.00	2.00	2.00	70.0	35.00
	2.00	3.70	1.70	120.0	70.58
	3.70	5.20	1.50	330.0	220.00
	5.20	6.00	0.80	350.0	437.50
	6.00	7.00	1.00	95.0	95.00
Willow Creek	0.00	6.00	6.00	5.0	0.83
	6.00	9.50	3.50	25.0	7.14
	9.50	14.00	4.50	95.0	21.11
	14.00	15.40	1.40	25.0	17.85
	15.40	18.60	3.20	10.0	3.13
	18.60	24.00	5.40	40.0	7.41
	24.00	27.60	3.60	300.0	83.33

3. Characteristics of the Drainage System

The Nottawasaga Basin is characterized by an extensive network of rivers and streams which collect the surface runoff and discharge into Georgian Bay.

The largest drainage system is the Nottawasaga River and its tributaries. It has a total length along its main channel of approximately 75.5 miles.

In the first 26 miles, it flows north-easterly, then swings north to follow a course near to the eastern edge of the former Lake Algonquin. South of the Minesing Swamp, the river enters the Simcoe Lowlands and meanders northward to Jack Lake.

From there, the flow is towards the west for about four miles following which a series of hairpin curves lead to a straight course to the northeast through the sand dunes of Wasaga Beach to the river's outlet into Georgian Bay.

From its source in the till moraines of Amaranth Township about three miles south of the Village of Shelbourne, at an elevation of about 1,600 feet, the river has a total fall of about 1,020 feet to the outlet at Georgian Bay. Its average gradient is 13.4 feet per mile, varying considerably from a flat gradient of 0.63 feet per mile near its mouth to a steep 100 feet per mile in the upper reaches near Glen Ross. The gradients of the Nottawasaga River, its main tributaries and other main rivers and creeks in the area are shown in Table 1-2. Water level profiles are in Figures 1-5, 1-6, 1-7 and 1-8.

The Nottawasaga River system has five major tributaries; the Boyne River (94 square miles), the Mad River (180 square miles) and Pine River (134 square miles), all on the west side, and Innisfil (179 square miles) and Willow Creeks (119 square miles) on the east side.

In addition, there are a number of streams that flow directly into Georgian Bay, the more prominent being the Pretty River, Batteaux River, Silver Creek and Underwood Creek in the northwest corner of the area. These streams rise on the Niagara Escarpment and are characterized by extremely steep gradients in the upper reaches and mild slopes as they approach Georgian Bay.

One of the peculiarities of the area is the almost complete lack of natural lakes. There are only three of any consequence; Edward Lake, Little Lake and Marl Lake. Jack Lake is shown on maps and known locally as a lake but is simply a swelling in the river. The three lakes have surface areas of 68, 626, and 191 acres respectively.

There are, however, a number of marshes and wetland areas such as the Minesing Swamp, the Osprey wetlands area in Osprey Township, and Beeton Flats in Tecumseth Township and the wetlands in Essa Township between Angus and Barrie. In total, the wetlands cover some 16,000 acres in the Nottawasaga watershed.



C.N.R. Culvert and railway embankment in Angus were washed out by "Hurricane Hazel" in 1954.

Section of County Road 13, west of Lisle. Replacement of culverts combined with channel improvements would lessen the flood hazard.



House built in flood plain land at Lisle. Appropriate zoning regulations can prevent situations like this in the future.

TEMPERATURE AND PRECIPITATION AT THE COLLINGWOOD WEATHER STATION; 30 YEAR NORMALS 1941-1970 .
 LATITUDE 44° 29' N. LONGITUDE 80° 13' W.
 ELEVATION 600 FT. A.S.L.

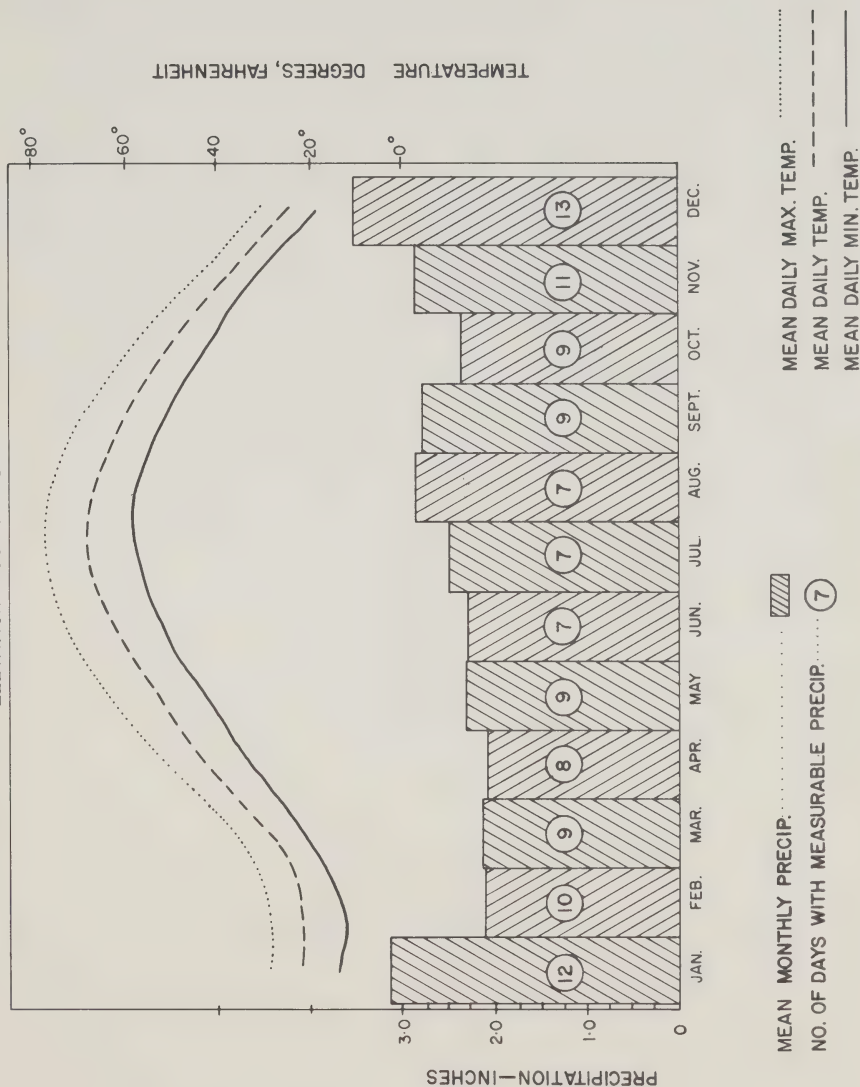


FIG. 1-2

TEMPERATURE AND PRECIPITATION AT THE ANGUS WEATHER STATION; 30 YEAR NORMALS 1941-1970.
 LATITUDE 44° 19' N. LONGITUDE 79° 52' W.

ELEVATION 627 FT A.S.L.

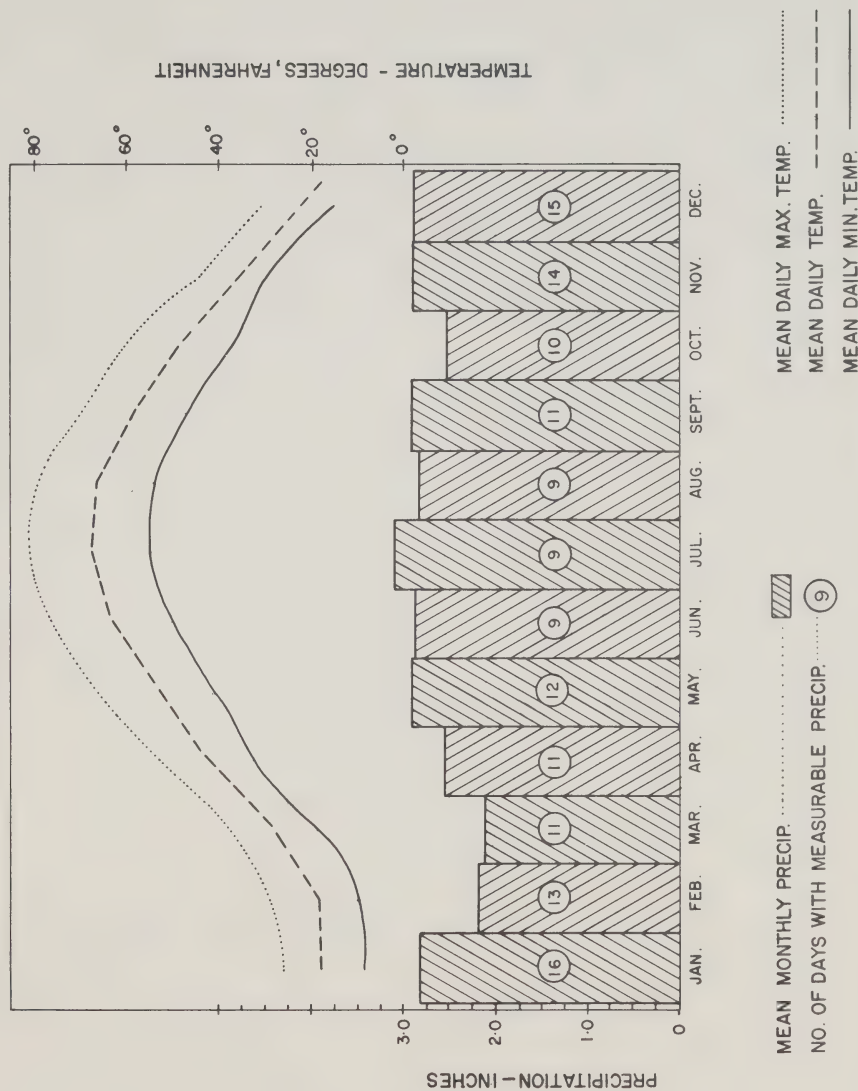


FIG. 1-3

TEMPERATURE AND PRECIPITATION AT THE BEETON WEATHER STATION; 30 YEAR NORMALS 1941-1970
 LATITUDE 44°06'N. LONGITUDE 79°47'W.
 ELEVATION 764 FT. A.S.L.

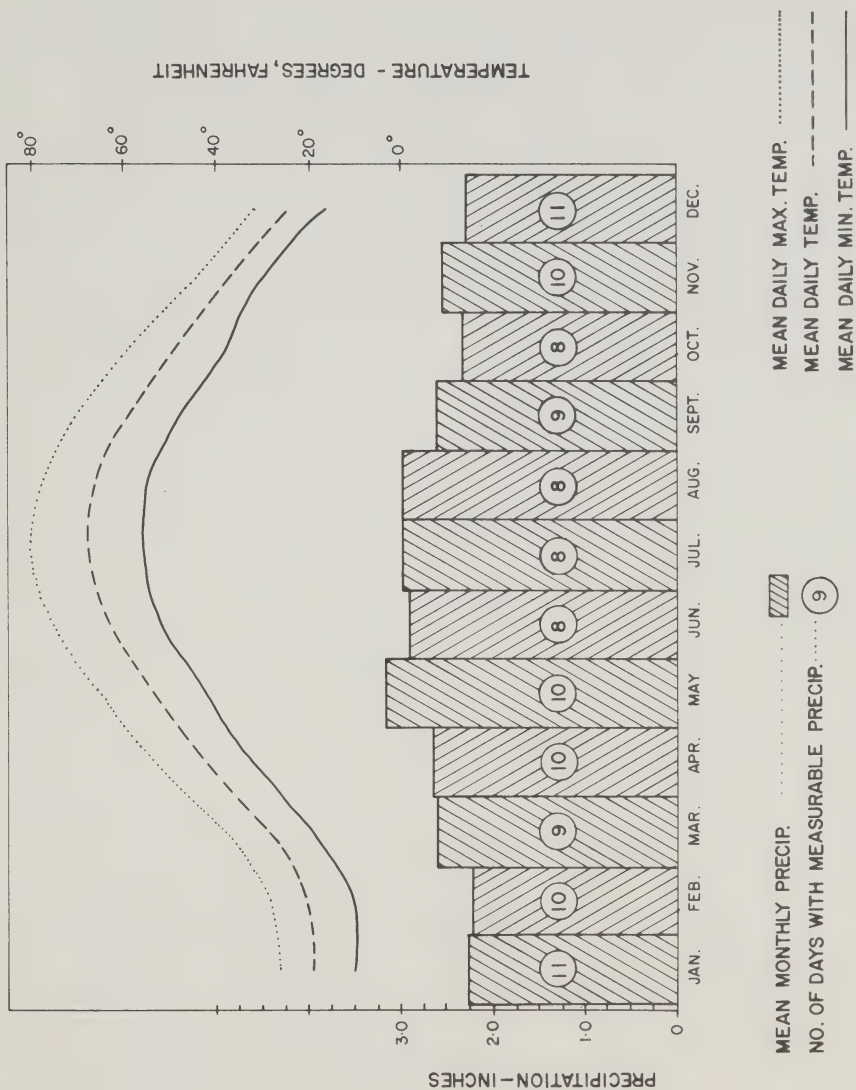


FIG. 1-4

WATER LEVEL PROFILE

NOTTAWASAGA RIVER AND EASTERN TRIBUTARIES

SCALES AS SHOWN

DEVELOPED FROM 1:50,000 TOPOGRAPHIC MAPS. N.B. - ONLY THE MAJOR TRIBUTARIES ARE SHOWN

* TRIBUTARY SHOWN IN DETAIL ON SEPARATE DRAWING FIG. 1-8

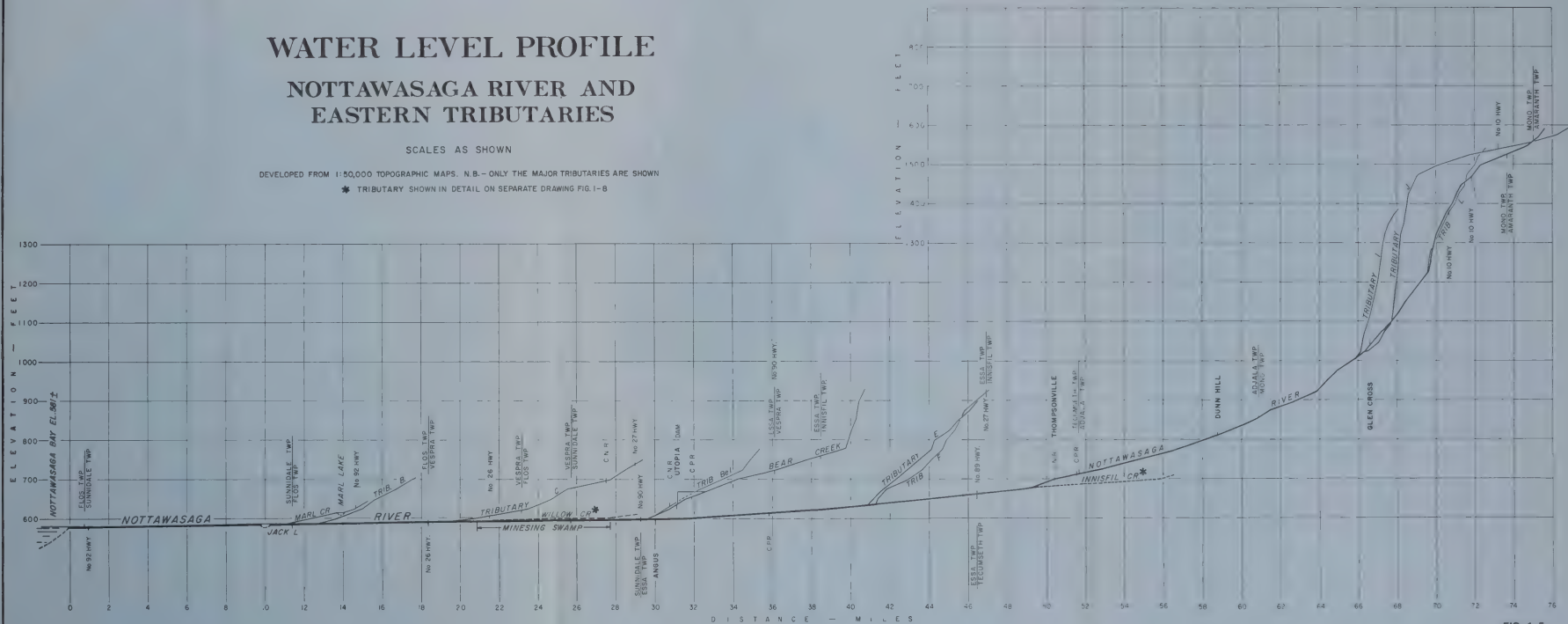


FIG. 1-5

WATER LEVEL PROFILE

NOTTAWASAGA RIVER AND WESTERN TRIBUTARIES

SCALES AS SHOWN

DEVELOPED FROM 1:50,000 TOPOGRAPHIC MAPS. N.B. - ONLY THE MAJOR TRIBUTARIES ARE SHOWN

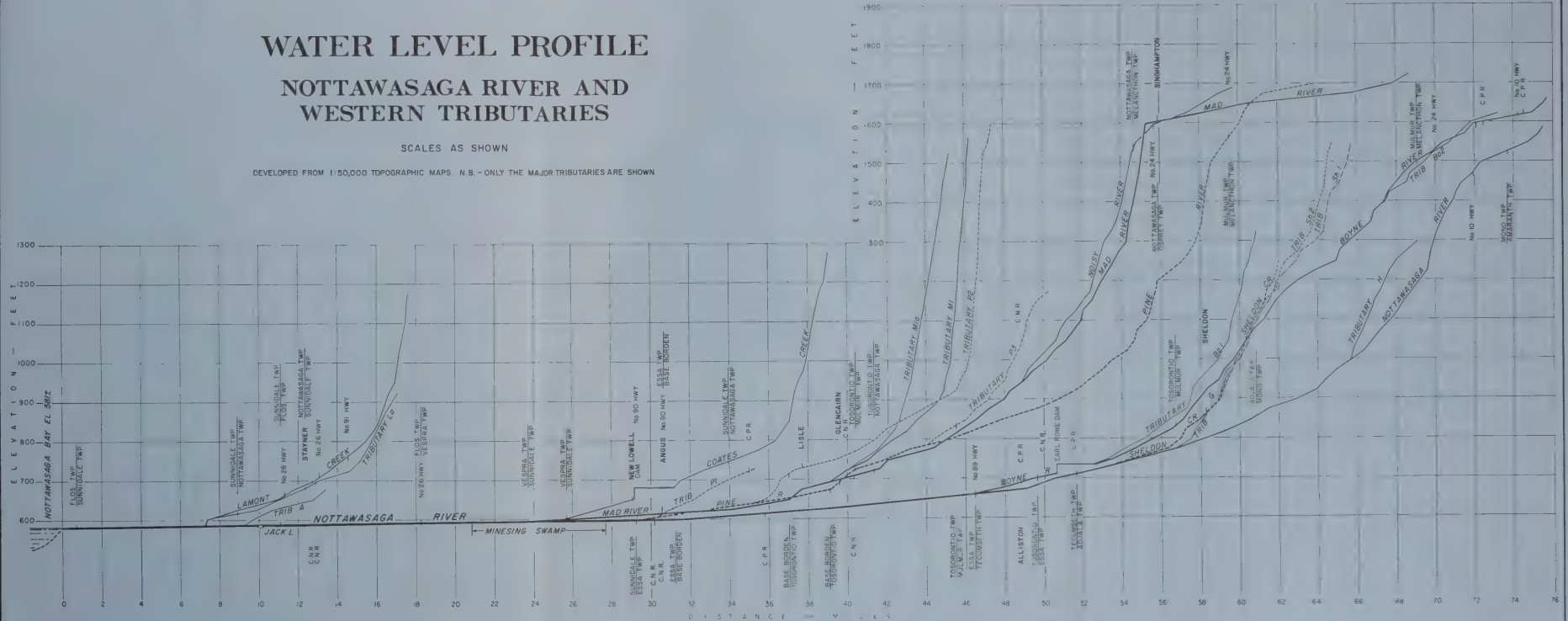


FIG. 1-6

WATER LEVEL PROFILES

SCALES AS SHOWN

DEVELOPED FROM 1:50,000 TOPOGRAPHIC MAPS. N.B. - ONLY THE MAJOR TRIBUTARIES ARE SHOWN

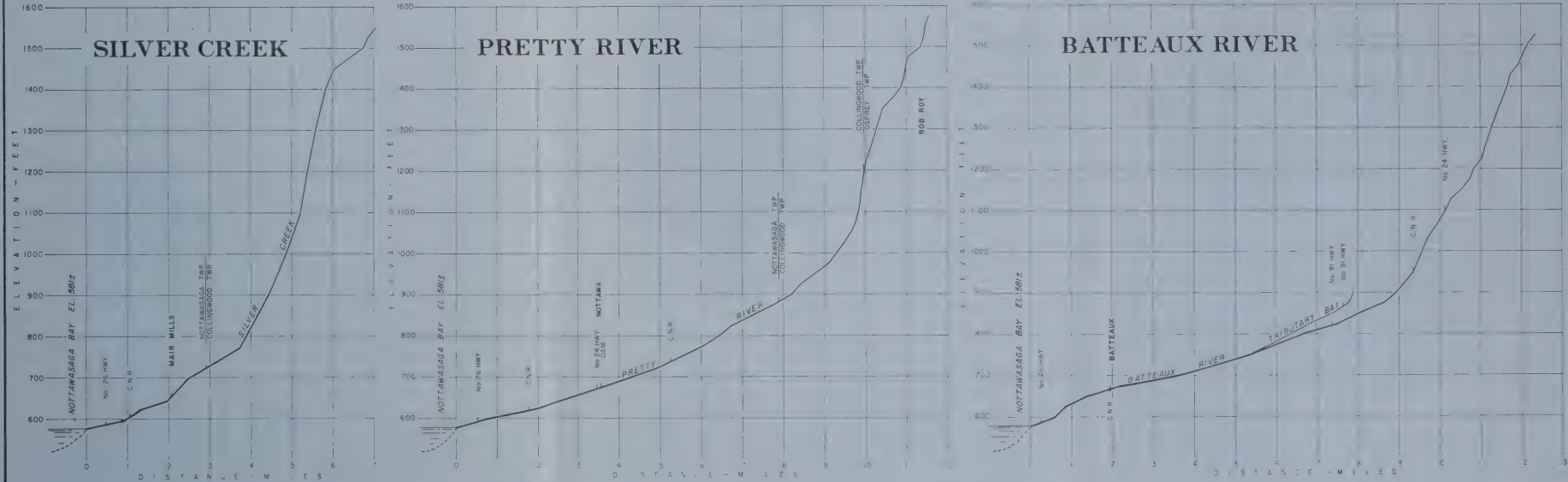


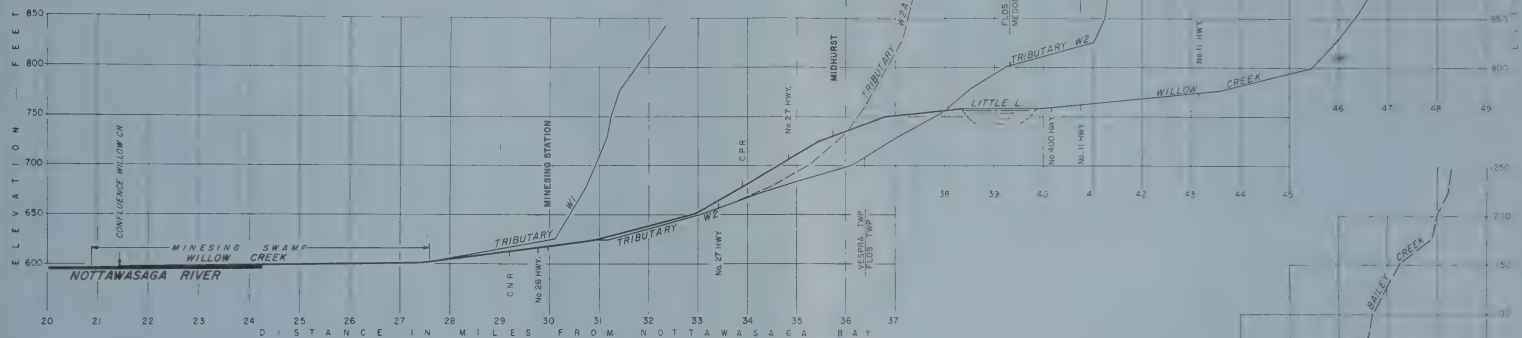
FIG. 1-7

WATER LEVEL PROFILE

WILLOW CREEK

SCALES AS SHOWN

DEVELOPED FROM 1:50,000 TOPOGRAPHIC MAPS



WATER LEVEL PROFILE

INNISFIL CREEK

SCALES AS SHOWN

DEVELOPED FROM 1:50,000 TOPOGRAPHIC MAPS



FIG. 1-8

Chapter 2 WATER RESOURCES

1. Water Yield

The total outflow from a drainage basin through surface or sub-surface channels is termed either water yield or runoff.

The amount of streamflow from any particular area depends upon a complex interaction involving precipitation, evaporation from open water, transpiration from vegetation and infiltration of water into the soil. These factors vary considerably over the Nottawasaga watershed and as a consequence there are also marked variations in water yield from stream to stream.

The average annual values of runoff range from 8 inches, or 25% of the precipitation in the southeast portion on the interlobate moraine area, up to about 16 inches, or 50% of the precipitation along the west side where the streams come off the Niagara escarpment.

This high yield area is also one where the slope of the river channels is very steep so that high flows are a common occurrence during the spring freshet.

Intense summer thunderstorms are also capable of producing flash floods throughout the watersheds, especially on those streams draining the escarpment.

Table 2-1 summarizes the available streamflow data for Bailey Creek and the Mad and Nottawasaga Rivers. Figure 2-1 shows a typical recording stream gauge installation.

2. Groundwater

Groundwater is the major water supply source in the watershed for domestic and industrial purposes, the notable exception being Collingwood. While there has been no complete study of all the possible sources of potable water in the area, a random sample of 62 households showed that 56.5 per cent relied on shallow wells, 20.9 per cent on deep wells, and 22.6 per cent on other sources for their water needs. The majority of the existing wells produce a reasonably good quantity of water; only one was reported to have gone dry during time of operation.

In Essa Township, between 1965 and 1967, a total of 81 new wells were drilled. Of these, 43 deep wells and 33 shallow wells produced water, while the remaining 5 were dry holes.

In general, the deep wells supplied larger quantities of water.

Table 2-2 summarizes the sources of municipal and industrial water supply within the watershed.

For more detailed information, reference should be made to the publication of the Ontario Water Resources Commission, now the Ministry of the Environment, "Ground Water in Ontario, 1971 and Preceding Years".

3. Water Quality

Factors affecting water quality in streams are numerous and complex, and include natural processes and the effects of urban and industrial development. Streams provide the only means of disposal for most of the wastes from the activities in the area and continual vigilance is required to maintain the quality of the water.

On the whole, the quality of the water in the streams of the Nottawasaga Valley area was found suitable for agricultural and municipal uses, although suspended and dissolved material was far from being absent.

During spring run-off, streams receive large volumes of easily erodible soil types without vegetative protection. The problem exists mostly on agricultural lands, but is also present in streams near construction projects, where appropriate measures to prevent erosion are not taken.

Silting of streams also occurs where streambanks deteriorate because livestock are permitted to enter the watercourse at unrestricted locations.

The main sources of chemical impurities are generally urban areas where streams sometimes receive untreated industrial or residential effluent. The heavy use of fertilizers in rural areas also contributes to chemical enrichment of streams.

A more complete discussion of the suspended and dissolved material content in the principal streams of the area is given in Chapter 3, Section 3.

4. Water Use and Management

In the past, the generation of water power was of major concern throughout the Nottawasaga Valley as is evident from the large number of abandoned or existing mill ponds and dams.

In all, over 44 dam sites were found, which indicates that at one time there was a dam for every 27 square miles of area in the watershed. Dams still exist on 31 of the 44 sites. Most of these are mill dams that have an average height of 10 feet and a pond area less than 10 acres. Available information shows that many of them were built in the mid-19th century and their present condition varies from poor to good, as shown in Table 2-3. Their location is shown on Figure 1-1.

With the availability of cheap, reliable electric power in recent years, many of these dams were no longer needed, and approximately 50 per cent of those still existing are retained for recreational or aesthetic reasons.

Other dams within the watershed include the Earle Rowe Provincial Park Dam on the Boyne River near Alliston, operated by the Ministry of Natural Resources, and the three recently-constructed multi-purpose reservoirs at New Lowell, Tottenham and Utopia, operated by the Nottawasaga Valley Conservation Authority.

There are no major existing water supply or flood control structures in the watershed area, although such structures may be justified in some areas. This subject is discussed in more detail in Chapter 4, Sections 1 and 2.

TABLE 2-1
SUMMARY OF MAXIMUM AND MINIMUM RECORDED FLOWS

Gauge Location	Drainage Area Sq. Miles	Number of Years of Record	Maximum Mean Daily Flow + CFS	Minimum Mean Daily Flow CFS	Peak Flow CFS	Peak Flow CSM*
Bailey Creek at Beeton	80	7	1130	0.0 July 17/1965 and 1964	1300 Apr. 8/1965	16.3
Mad River at Glencairn	114	7	2100	7.4 Nov. 20/1967	5930 Feb./1963	52.0
Nottawasaga River at Baxter	456	26	9430	26.6 July 21/1966	**13013 April/1961	28.6

+C.F.S. — Cubic Feet per second.

*C.S.M. — Cubic Feet per second per square mile of drainage area.

**Using Peak flow/Max., mean daily flow ratio of 1.38.

SOURCES: Water Survey of Canada, Surface Water Data.

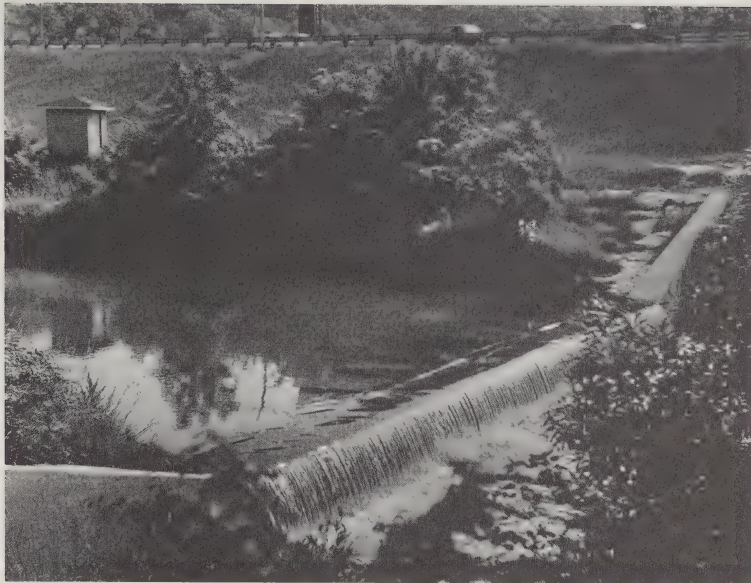
TABLE 2 - 2
*MUNICIPAL AND INDUSTRIAL WATER SUPPLY

Municipality	Actual Population in 1,000's	Ownership	Population Served in 1,000's	Source of Water	Average Daily Pump 10 ⁶ Gals.	Plant Design Capacity MGD	Storage Capacity 10 ⁶ Gals.	Number of Services	Cost per 1000 Gals. to System (Cents)	Supply to Outside of Municipality	Remarks
Alliston	3.2	Mun.	3.5	Wells	0.8	1.8	0.2	1200	20	Yes	4 deep wells
Angus	1.1	Priv.	N.A.	Wells	N.A.	N.A.	0.02	N.A.	N.A.	No	2 private systems
Beeton	1.1	Mun.	N.A.	Springs	0.1	N.A.	0.22	N.A.	N.A.	No	
Camp Borden	N.A.	Gov't.	N.A.	Wells	2.0	3.0	N.A.	N.A.	N.A.	Yes	4 wells
Collingwood	9.5	Mun.	9.5	Lake	4.0	12.0	0.5	3600	15		Heavy industrial consumption
Cookstown	0.8	Mun.	N.A.	Well	0.09	0.09	0.2	N.A.	N.A.	N.A.	Supply adequate
Creemore	0.9	Mun.	N.A.	Springs River	0.09	0.2	0.12	N.A.	N.A.	No	Supply not adequate in summer
Mansfield	0.1	Priv.	N.A.	Well	N.A.	N.A.	N.A.	20	N.A.	No	
Minesing	0.2	Mun.	N.A.	Well	0.03	0.08	0.01	N.A.	N.A.	No	No adequate supply
Shelburne	1.5	Mun.	1.5	Wells	0.1	0.4	0.2	686	28	Yes	
Stayner	1.9	Mun.	N.A.	Well & Springs	0.15	N.A.	0.6	N.A.	N.A.	No	Adequate supply
Tottenham	1.3	Mun.	N.A.	Wells	0.13	N.A.	N.A.	N.A.	N.A.	No	

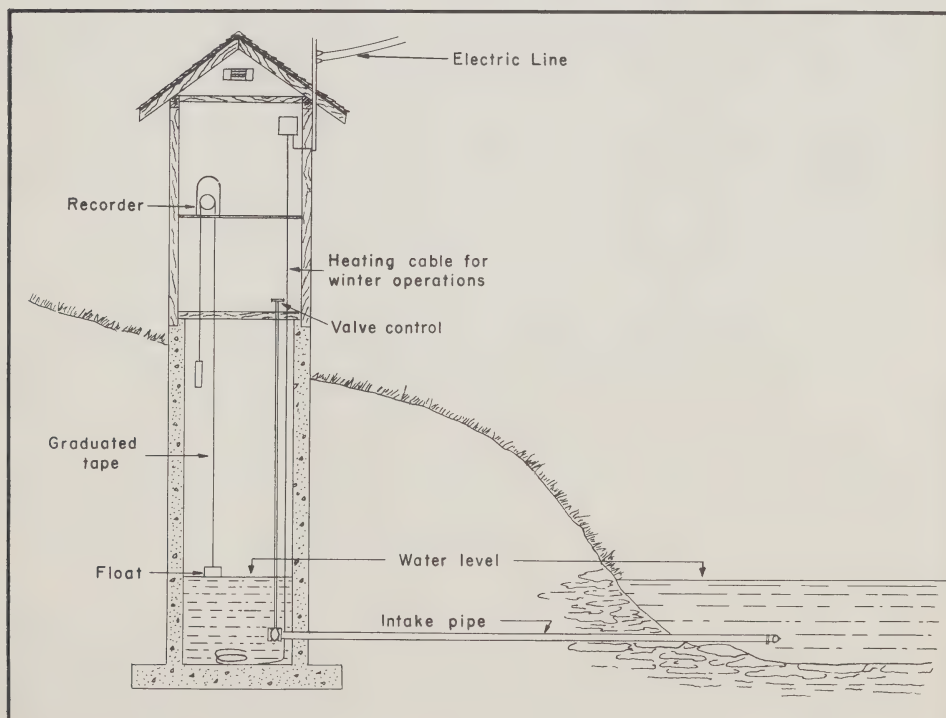
*SOURCES: "Water and Pollution Control Directory 1970-71" and Field Interviews.
Municipal Directory 1971.

TABLE 2 - 3
EXISTING DAMS AND RESERVOIRS

Stream	Location	Height of Dam (Ft.)	Surface Area of Reservoir (Acres)	Purpose	Approx. Age of Dam (Yrs.)	Condition of Dam
Mad River	Lot 18, Con. XII Nottawasaga Twp.	9.0	10.0±	Recreation	130	Fair
	Lot 16, Con. VIII Nottawasaga Twp.	22.0	2.0±	Mill	70	Fair
Coates Creek	New Lowell (NVCA)	29.0	45.0±	Multi purpose	4	Good
Bear Creek	Utopia (NVCA)	30.0	9.0±	Multi purpose	4	Good
Noisy River	Lot 6, Con. IX Nottawasaga Twp.	5.0	0.5±	Recreation		Good
	Lot 1, Con. XII Nottawasaga Twp.	10.0	0.3	Recreation		Good
	Lot 32, Con. II Melancthon Twp.	10.0	10.0	Recreation and Wildlife		Fair
Pine River	Lot 26, Con. I Mulmur (EHS)	8.0	Silted up	Mill	80±	Poor
	Lot 14, Con. II Melancthon Twp.	8.0	10.0	Recreation		Good
	Lot. 14, Con. I Melancthon Twp.	16.0	6.0±	Mill	120±	Fair
	Lot. 15, Con. I Melancthon Twp.	12.0	3.0±	Mill	120±	Fair
	Lot 19, Con. II Mulmur (WHS)	12.0	10.25	Fish Hatchery	40±	Good
	Lot 21, Con. I Mulmur (WHS)	15.0	2.0±	Recreation	25±	Good
	Lot 20, Con. I Mulmur (WHS)	3.0	0.5±	Recreation		Fair
Boyne River	Lot 6, Con. III Mulmur (WHS)	10.0	10.0±	Fishing		Good
	Lot 4, Con. II Mulmur (WHS)	15.0	0.5±	Recreation	40±	Fair
	Lot 8, Con. VI Mulmur (WHS)	12.5	3.0±	Recreation		Fair
Cookstown Creek	Lot 22, Con. XIV Tecumseth	6.5	1.0±	Recreation		Fair
Beeton Creek	Tottenham (NVCA)	30.0	25.0±	Multi-purpose	3	Good
Bailey Creek	Lot 12, Con. VII Adjala	5.7	3.0±	Recreation		Fair
Nottawasaga River	Lot 7, Con. II Essa Twp.	14.0	2.0±	Recreation	12	Good
	Lot 18, Con. III Mono Twp.	5.0	1.0±	Recreation		Fair
	Lot 18, Con. IV Mono Twp.	12.0	0.75±	Recreation	25±	Good
	Lot 1, Con. IV Essa Twp.	12.5	1.0±	Mill	120±	Fair
	Lot 2, Con. VI Tosorontio Twp. (Earl Rowe)	25.0	90.0	Multi-purpose	7	Good
Sheldon Creek	Lot 24, Con. VIII Mono Twp.	7.5 & 14.0	2.0±	Mill	70±	Fair
Silver Creek	Lot 18, Con. XII Nottawasaga Twp.	9.5	1.0±	Recreation		Fair



TYPICAL STREAM GAUGE STATION



TYPICAL STREAM GAUGE INSTALLATION

Chapter 3

WATER AND RELATED LAND PROBLEMS

1. Flooding

Flooding has been of major concern throughout the history of the Nottawasaga area.

Newspaper reports from the 1800's onwards describe floods within the area with frequent regularity. Unfortunately, early accounts do not provide sufficient information regarding values of flood damages, the amount of precipitation and other matters. Frequently, reports are limited simply to describing inundated areas.

Table 3-1 summarizes newspaper reports of significant floods within the Authority's area. Other records of lesser floods are not included in this table.

There is no evidence that the magnitude or frequency of flooding has increased in recent years. However, it is apparent from the surveys that damages resulting from flooding have increased. This can be attributed to the continued indiscriminate development of flood plain lands.

Serious damages may result from lack of or improper operation of dams. In the event of a dam failure, the sudden release of a large volume of water without sufficient warning to downstream interests can have devastating effects, including loss of life. For this reason, great care should be exercised in the maintenance and operation of dams.

Another cause of local flooding and deterioration of river channels within the area is log jamming.

In the past few years there has been considerable cutting in the watershed of elm trees that have succumbed to dutch elm disease. Many have been left to lie in the flood plain and have been carried away by high flows during the spring run-off. Eventually log jams are formed at narrow sections of the stream channel as well as at culverts and bridges. The jams act as dams, collecting more debris and causing excessive streambank erosion and subsequent sediment deposition downstream.

Many log jams were observed during the survey. Along the Mad River there were several dozen between its confluence with the Nottawasaga River and Glencairn, and a large number of the upper reaches of the Nottawasaga River, especially between Hockley and Glen Cross. Some of these obstructions were 150 feet wide and continued for several hundred feet along the rivercourse. Removal of these obstructions would involve expense and would serve only a limited and temporary purpose without removal from the flood plain of dead elms that are already cut or ready to fall.

The Authority should embark on a systematic dead-elm tree removal program as soon as possible. A large portion of any such program could be administered within the framework of the winter works program. If no action is taken, the formation of log jams could create serious flooding and erosion problems.

a. Rural

Most flood damages sustained in the rural areas are in the form of crop losses, field erosion, loss of livestock and fences, silt deposits on the fields, contamination of wells and ponds, and the deterioration or destruction of roads and bridges.

The greatest damage resulting from a single flood occurred as a result of storm "Hurricane Hazel" in October, 1954. Six lives were lost during this storm within the Authority's area.

In the portion of the Authority that falls within Simcoe County alone, government aid to flood victims totalled \$151,000. Bearing in mind that this aid covered only a portion of the sustained losses, and that there has since been a substantial rise in construction costs and the value of livestock, similar damages today would probably cost in the region of \$1,000,000.

Field inspection, interviews with local residents, as well as interpretation of aerial photographs, disclosed wide-spread seasonal flooding in the Nottawasaga area. It occurs along Bailey Creek, Batteaux River, Beeton Creek, Black Ash Creek, Lamont Creek, Innisfil Creek, Lisle Creek, Mad River, Nottawasaga River and Penville Creek. The location of areas subject to flooding is shown on Figure 3-1. Figure 3-2 shows the extent of the area in the Minesing Swamp flooded in the Spring of 1972.

b. Urban

Several municipalities have reached the critical stage of flood plain development where high flows would result in severe property damage. Angus, Beeton, Collingwood and Creemore are the principal areas where remedial measures such as dyking, channel improvements and flood plain zoning are required to minimize the impact of flooding.

Flood-prone areas should be used only for purposes that can tolerate reasonable seasonal flooding without significant property damage or danger to human life, e.g. park lands, golf courses, parking areas, agriculture, etc. This type of control is particularly applicable to communities such as Cookstown, Stayner, Lisle and other hamlets and potential resort areas where development probably will occur.

2. Erosion

Erosion is a natural geological process which has been taking place since the beginning of time, and is largely responsible for the development of the present topography of the Nottawasaga area. The removal of vegetative cover and other human actions have accelerated the process to serious proportions.

There are two principal types of erosion; geological and accelerated erosion. Geological erosion includes natural soil-creating as well as soil-displacing processes which maintain the soil in favourable balance. Accelerated erosion is the deterioration and loss of soil as a result of man's activities.¹ Both types of soil erosion were observed in the Nottawasaga area with the accelerated form being more prevalent.

Accelerated erosion causes deposit of silt in drainage ditches, streams and reservoirs, and the removal of valuable topsoil and large quantities of fertilizers, which are washed into watercourses and adversely affect the quality of the water.

a. Wind Erosion

The major factors influencing erosion by wind are: wind velocities, duration and direction, soil type, vegetative cover, amount of soil moisture and agricultural practices.

Evidence of wind erosion in the form of "blow outs" was observed in Mulmur Township near Mansfield, in Nottawasaga Township northwest of Creemore, in the sand dunes of Sunnidale Township south of Wasaga Beach, and within the boundaries of Base Borden, west of Angus.

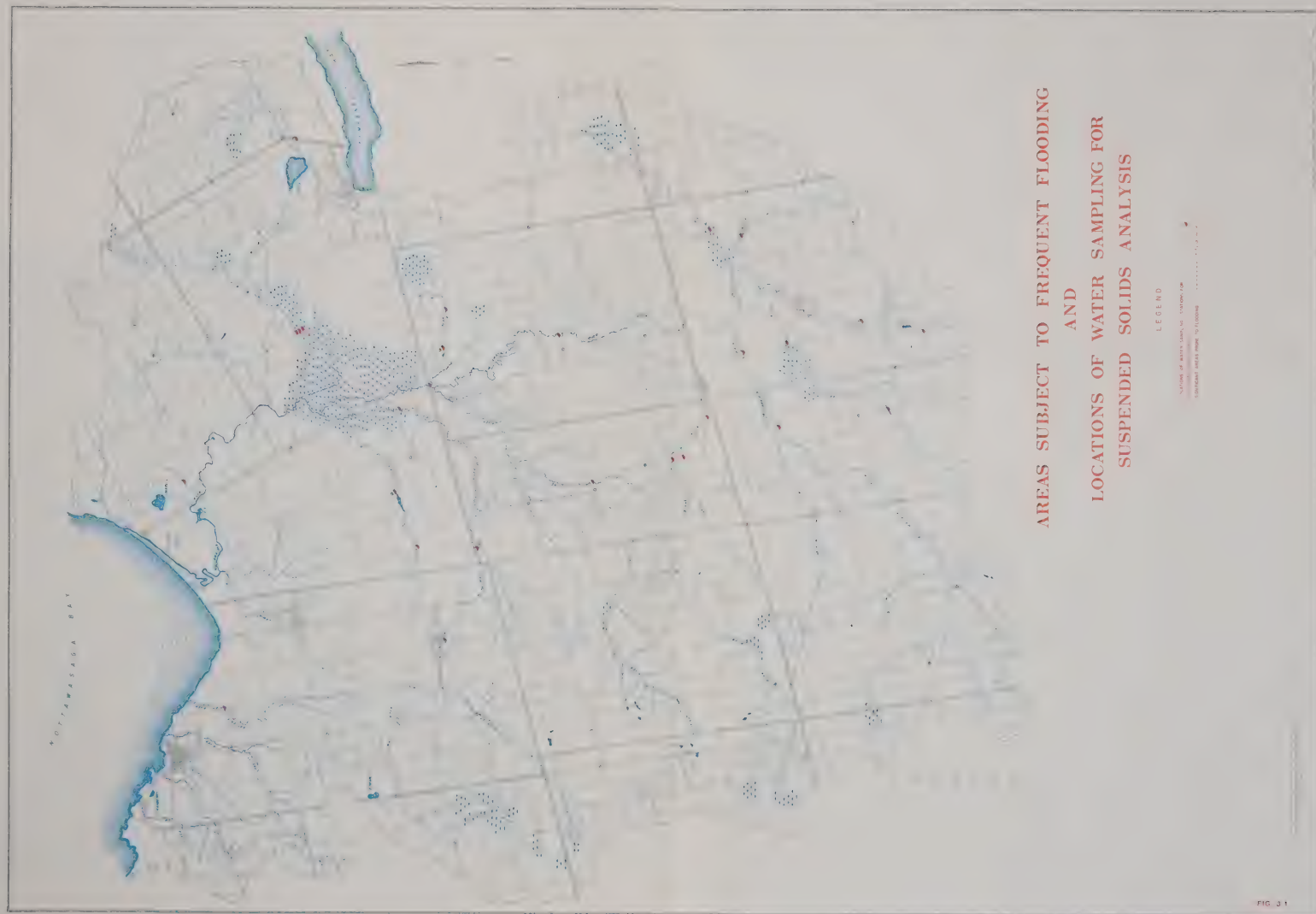
Dust storms were also observed northeast of Alliston during moderate wind conditions on two occasions in the summers of 1971 and 1972.

It is essential that measures be taken to protect the soil from heavy losses in the future. Establishment of suitable windbreaks and/or tree plantings in the Alliston area are needed. In the Wasaga Sand Dunes area, great care should be exercised in any future development since removal of vegetation from these relatively light, unstable soils would further accelerate their erosion.

b. Geological Erosion by Water

The erosion brought on by water can be placed in two main groups: erosion taking place in soil bordering water, such as riverbanks and lakeshores, and erosion caused mainly by rain and surface run-off.

¹ Soil and water Conservation Engineering by G.O. Schwab, R.K. Frevert, et al.





FLOOD PLAIN
OF THE
NOTTAWASAGA RIVER SYSTEM
IN THE
MINESING FLATS
SHOWING THE EXTENT OF THE 1972 SPRING FLOOD



FIG. 3-2

TABLE 3-1
LIST OF RECORDED FLOODS

Date	Location	Source of Information	Reported Damage
June 6, 1890	Barrie and surrounding area	Toronto Globe	GTR railroad washed out 400' in length. Wash outs in some cases 60' deep.
April 9, 1912	Boyne River at Alliston	Toronto Globe	River carried away four bridges, washed out all mill dams.
Feb. 13, 1932	Nottawasaga River, Minesing Flats	Toronto Globe	The Nottawasaga River rose to 6' above normal, flooding the Minesing Flats, farmers resorted to boats for transportation.
Dec. 19, 1950	Pine River Tioga	CNR	30' x 8' bridge washed out.
Feb. 22, 1937	Mad River at Creemore	Evening Telegram	Mad River rose to flood stage in less than two hours. Public School and continuation school surrounded by water.
April 6, 1950	Pine River and Nottawasaga River at Angus	Toronto Globe	Both approaches of Hwy. 90 bridge washed out. Highway flooded at Nottawasaga River bridge.
April 11, 1950	Pine River and Boyne River at Mulmur	Toronto Globe	Miles of roads in central Mulmur were ruined by the rampaging Pine River. Mulmur lost seven bridges. Tremendous force of flood waters carried steel bridge 200 yards downstream on the 7th Line. Many farmers were virtually isolated.
Oct. 18, 1954	Pennville Creek near Beeton	Alliston Herald	Four people lost their lives in the waters of Pennville Creek. Damage enormous.
March 26, 1963	Cookstown Creek	Barrie Examiner	Hundreds of acres lay under water at the village limits ... the westbound lane of Hwy. 89 was washed out.
June 29, 1967	Bailey & Beeton Creeks at Beeton Flats	Barrie Examiner	Entire crops of potatoes, up to 1,000 acres in the Beeton area alone, corn and grain in north Simcoe have been wiped out in wake of flood, worst since Hurricane Hazel.

There are direct relationships between topography and rainfall. Some of the main factors are:

The amount and intensity of rainfall, which determine run-off; the greater the surface run-off, the more erosion is likely to take place.

Soil types — noncohesive soils (i.e. sand, silt) are removed more readily than cohesive (clay) types.

Surface slopes — the steeper the slope, the greater are both run-off and erosion.

Vegetative cover — bare or sparsely covered slopes are more susceptible to erosion than those with a well-established vegetative cover.

There are three relatively distinct processes by which moving water erodes material and therefore modifies the slopes composing a landscape.² These are *sheet*, *rill* and *gully* erosion.

i. *Sheet Erosion*

On flat, gently sloping surfaces, rains wash away loose soil particles and carry them down the slopes in broad sheets. This type of erosion is fairly widespread in the watershed and occurs chiefly on cultivated fields.

ii. *Rill Erosion*

When run-off water on a sloping surface concentrates into streamlets, small channels known as rills are formed. These tend to collect more water which accelerates the erosion. Any soil surface is susceptible to rill erosion but construction sites and cultivated fields where the protective vegetative cover has been removed are particularly vulnerable.

iii. *Gully Erosion*

If rill erosion is permitted to continue unchecked, the rills will increase in size with each rainstorm and the larger they become the more water they carry. The erosion is thus intensified and the rill eventually develops into a gully. The shape of the gully is partly determined by the texture, the cohesiveness and permeability of both the topsoil and subsoils.

Gullies can be classified as *active* or *stable*.

In a typical case of an active gully, lengthening results from erosion at the head while water washing down the sides causes widening, the effect being to deepen the gully and advance the head farther upstream. At the same time, flow along the bottom cuts the gully still deeper. With continued enlargement, the gully eventually grows into a valley. A stable gully is one where the erosion has been slowed down either by natural vegetative cover on the slopes or by some artificial means to the point where growth is no longer appreciable. There were numerous active gullies observed within the Authority, some of them over 20 feet deep and over 100 feet wide at the top. The more prominent ones are shown on Figure 3-3 in this report.

Controlling an active gully can be a costly and laborious undertaking, often beyond the means of individual landowners. It is therefore wise to arrest development of gully erosion in its initial stages.

iv. *Streambank Erosion*

Stream bank erosion is a natural and continuous process which occurs in all streams, although each tributary has its own rate of erosion which in turn varies from point to point throughout its length. Severe spot erosion was found to exist in 90% of all streams examined in the Nottawasaga area. Examples were found of both erosion above the water-line and erosion below the water-line.

² Forecasting Trafficability of Soils, by U.S. Corps of Engineers, Vicksburg, Mississippi

Failure to remove cut trees such as these elms from the flood plain will produce problems such as...





this large log jam on the Mad River. . . .



or this log jam on the Pine River near Base Borden.



Log jams precipitate erosion of river banks and lead to silting downstream.

Above the Water-line

The failure of the stream bank to support steep side slopes manifests itself by the movement of soil outward and downward at its toe. This phenomenon, commonly called slumping, gives rise to further erosion as the loose material is readily transported away by the flowing water.

Below the Water-line

The failure of streambanks due to the scouring forces of water is called undercutting. This usually takes place at the outside banks of bends in the river due to the higher velocities and correspondingly greater erosive power of the flowing water. Unless some protection is placed at the toe of the bank, the undercutting continues until the banks collapse.

Many miles of undercut streambanks were observed in 1971 and 1972, most of them on the Mad, Boyne and Nottawasaga Rivers. In some cases, attempts have been made to control undercutting. However, it is still too early to assess the effectiveness of the remedial works.

Livestock

Uncontrolled grazing and watering of cattle can cause the collapse of streambanks by removal of vegetative cover and changing of soil structure by continuous trampling. This is a common occurrence along many streams. The problem could easily be eliminated by controlling access to the streams.

3. Sedimentation

Sediment is organic or mineral solid matter that is transported by water, wind, ice or gravity. Of these, water is by far the most important agent, although wind action also plays a major role because of the nature of the soils, particularly along the Georgian Bay shoreline.

Erosion of soil is the main producer of sediments which create problems in the region, such as filling in reservoirs and navigable channels. Destruction of valuable agricultural lands is also occurring through loss of topsoil and the smothering of good soil with less fertile or barren soils.

Within the Great Lakes Basin, which includes the Nottawasaga area, it is estimated that about 165 million tons of material are removed each year and carried by various streams and rivers.¹ This quantity corresponds to an average of 557 tons of sediment for every square mile of the Basin, and in terms of the Nottawasaga area, this amounts to about 674,000 tons annually.

On the whole, the soils of this area are considered to have medium to high erosive characteristics. For this reason, a number of mill ponds have had to be dredged to remove silt accumulation, and others are no longer operational because of the same problem.

As part of the field surveys for this report, a sediment sampling program was undertaken during the summer and fall of 1971 to obtain an overall picture of the contamination of rivers and streams by suspended and dissolved matter.

This program was directed to the more prominent streams and rivers in the watershed and the analysis was carried out at the laboratories of Georgian College of Applied Arts and Technology.

The results of the sampling program are summarized in Table 3-2, and the location of the sampling stations are shown on Figure 3-1.

As can be seen, the greatest concentration of suspended solids was found in the Mad River, east of Brentwood, where 296 ppm* was recorded. The lowest sediment load was in a branch of Willow Creek where 1 ppm was obtained.

¹ U.S. Great Lakes Basin Commission and U.S. Soil Conservation Service



Sediment deposit along the south bank of the Boyne River downstream of a log jam. In this section the River carries a heavy load of sediment.



Reservoir on the Noisy River at Maple Valley. Vegetative growth in pond area indicates heavy silt accumulation.

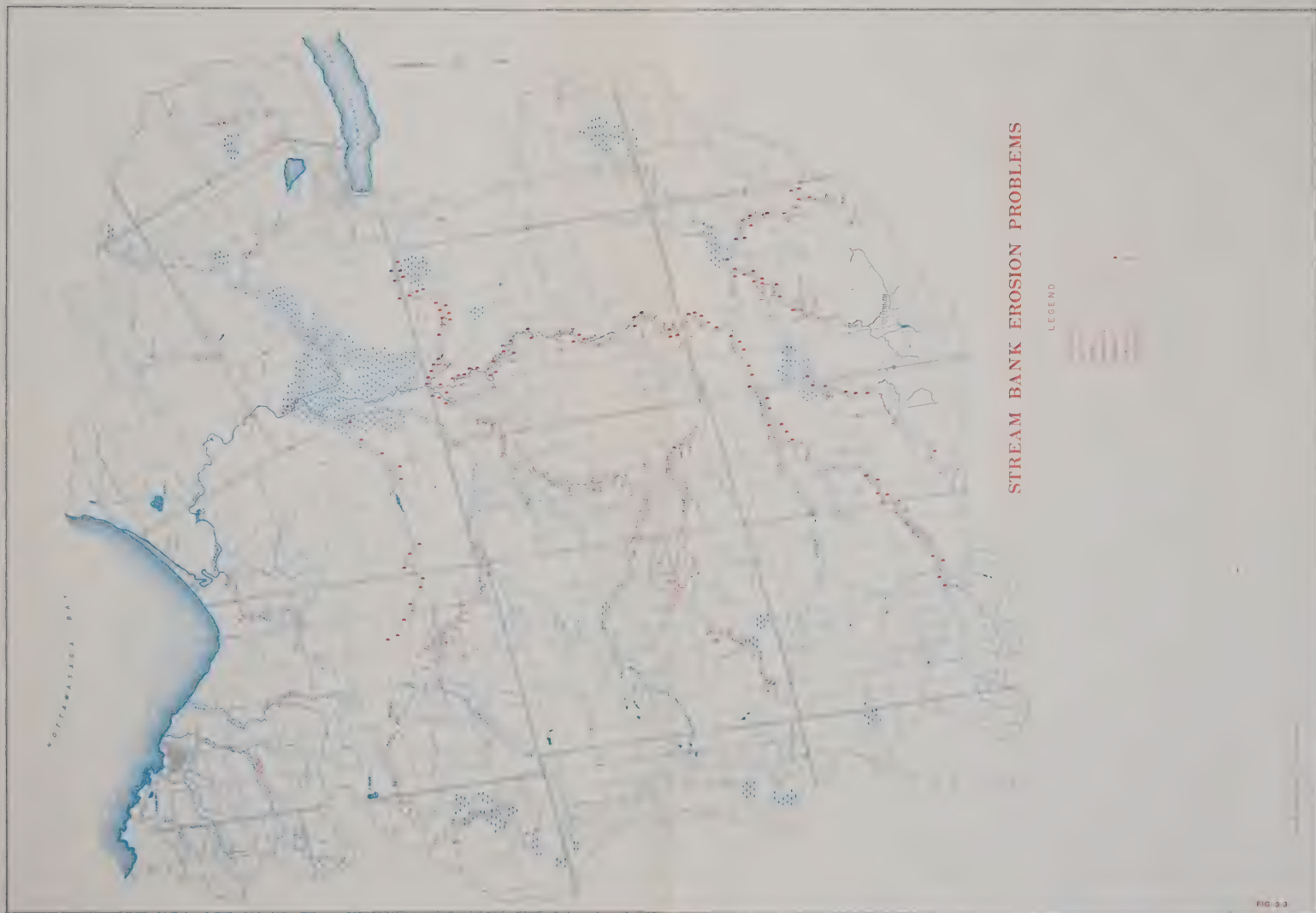
Advanced rill erosion in Concession V, Essa Township. Lack of top soil and vegetative cover are prominent.



Bank erosion in Concession IV Essa Township caused by cattle. Control is necessary to prevent further deterioration and the formation of gullies.

Poorly designed road cut resulted in this accelerated erosion of the slope.







Severe streambank erosion at Nottawasaga River Bridge has resulted from this log jam.



Spring flooding frequently leaves sediment deposits in roadside and field ditches. This example is in the Mad River Floodplain downstream of Angus.

The lowest average load of suspended solids was also found in the Mad River at Creemore, where the load ranged between 3 ppm and 11 ppm for a period of 11 months.

Sediment accumulation was studied in two storage reservoirs which are operated by the Nottawasaga Valley Conservation Authority: The New Lowell reservoir on Coates Creek, and the Utopia reservoir, which is within the Bear Creek drainage basin. Typical cross-sections of these reservoirs are shown on Figures 3-4 and 3-5 respectively.

The results of the study indicated that for a period of 3 years, the total silt deposits amounted to 35.5 and 5.73 acre-feet in the New Lowell and Utopia reservoirs respectively. This represents a loss in storage of approximately 10% for the Utopia reservoir. It was not possible to determine the percentage loss in storage for New Lowell because of the lack of a complete contour plan of the reservoir area, but the evidence indicates a loss somewhat greater than that for Utopia.

While there were no silt depth measurements taken in the Earl Rowe reservoir at Alliston, analysis of the water samples indicated that a large portion of the suspended solids carried by the Boyne River are deposited in the reservoir. From available information, it is estimated that the rate of sediment accumulation in the reservoir storage area is in excess of 2% per year.

4. Surface Drainage

The majority of local drainage problems within the watershed are due to a high water table in areas of poor draining soils. This condition is prevalent throughout the low-lying central part of the area as indicated by the Beeton Flats Water Management Study¹ which recorded problems in the locality of Innisfil Creek and its tributaries, Penville Creek, Bailey Creek and Sheldon Creek.

High water table conditions were also found to exist along Lisle Creek and Willow Creek from time to time, and in the Townships of Adjala and Tecumseth.

In the latter two areas, a concerted effort has been made to alleviate the situation by construction of drainage ditches totalling in excess of 130 miles. In spite of this, the problem still exists for many landowners, and while standard drainage methods may alleviate the problem, each case should be investigated carefully to determine the overall short and long term effects.

Grass Waterways

A grass waterway is a broad shallow ditch which generally follows the natural drainage course. It has gently sloping banks, usually less than 4:1² in which suitable grasses are grown and maintained throughout its existence. Its cross section resembles a parabola and its longitudinal slope is not excessive.

The primary purpose of the grass waterway is to convey the heavy surface run-off from fields to streams at velocities slow enough that soil erosion will be prevented or negligible at worst.

The grass waterway should be at least 14 to 16 feet wide to permit proper mowing. It is essential that it not be used as a ford for heavy farm machinery. Traversing the grass waterway with implements, especially in the spring, encourages erosion of its banks and defeats its purpose.

It is recommended that the Authority publicize the drainage advantages offered by grass waterways and encourage their construction. Technical advice and assistance in design is available from the Conservation Authorities Branch for interested parties who apply through the Authority.

Grass waterways would be especially beneficial in the Townships of Essa, Sunnidale and Tosorontio, where light-textured and sandy soils are often found.

¹ Report on Beeton Flats Water Management Study, April, 1971 James F. McLaren Ltd., Consulting Engineers.

² Soil and Water Conservation Engineering Schwab, Frevert, et al.

TABLE 3 - 2
SUSPENDED AND DISSOLVED SOLIDS IN SELECTED STREAMS

Stream	Location of Sampling Station	Date of Sample	Amount of Solids PPM*			Remarks
			Suspended	Dissolved	Total	
Bailey Creek	Lot 12, Con. V Adjala Twp.	June 14/71	70	224	294	
		July 13/71	25	238	263	
		Aug. 18/71	21	270	291	
		May 3/72	117	340	457	
	Lot 5, Con. X Tecumseth Twp.	June 14/71	4	240	244	
		July 13/71	46	209	255	
		Aug. 18/71	34	241	275	
		May 3/72	10	387	397	
Batteaux River	Lot 36, Con. VI Nottawasaga Twp.	June 14/71	64	176	240	
		July 13/71	—	—	—	Not taken
		Aug. 18/71	17	216	233	
		May 3/72	66	296	362	
Bear Creek	Lot 28, Con. VIII Essa Twp.	June 14/71	138	197	335	
		July 13/71	22	248	270	
		Aug. 18/71	12	222	234	
		May 3/72	10	208	218	
	Lot 30, Con. V Essa Twp.	June 14/71	48	332	380	
		July 13/71	3	166	169	
		Aug. 18/71	25	257	282	
		May 3/72	47	308	355	
Beeton Creek	Lot 4, Con. III Tecumseth Twp.	June 14/71	137	289	426	
		July 13/71	10	284	294	
		Aug. 18/71	34	296	330	
		May 3/72	116	250	366	
	Lot 7, Con. VI Tecumseth Twp.	June 14/71	211	171	382	
		July 13/71	32	271	303	
		Aug. 18/71	36	329	365	
		May 3/72	29	270	299	
Boyne River	Lot 7, Con. V Tosorontio Twp.	June 14/71	155	169	324	
		July 13/71	64	193	257	
		Aug. 18/71	74	165	239	
		May 3/72	89	319	408	
	Lot 6, Con. V Tosorontio Twp.	June 14/71	100	199	299	
		July 13/71	69	221	290	
		Aug. 18/71	97	204	301	
		May 3/72	65	267	332	
Coates Creek	Lot 2, Con. VII Tosorontio Twp.	June 14/71	10	276	286	
		July 13/71	64	210	274	
		Aug. 18/71	20	227	247	
		May 3/72	7	267	274	
	Lot 3, Con. IV Sunnidale Twp.	June 14/71	47	253	300	
		July 13/71	13	303	316	
		Aug. 18/71	22	193	215	
		May 3/72	74	213	287	
Innisfil Creek	Lot 22, Con. III Sunnidale Twp.	June 14/71	71	148	219	
		July 13/71	28	186	214	
		Aug. 18/71	12	220	232	
		May 3/72	132	184	316	
	Lot 20, Con. XII Tecumseth Twp.	June 14/71	28	269	297	
		July 13/71	148	249	397	
		Aug. 18/71	41	310	351	
		May 3/72	22	386	408	
Marl Creek	Lot 24, Con. VI Flos Twp.	June 14/71	19	352	371	
		July 13/71	4	224	228	
		Aug. 18/71	101	304	405	
		May 3/72	66	258	324	

*PPM — parts per million of weight

TABLE 3 - 2
SUSPENDED AND DISSOLVED SOLIDS — *continued*

Stream	Location of Sampling Station	Date of Sample	Amount of Solids PPM *			Remarks
			Suspended	Dissolved	Total	
Mad River	Lot 9, Con. V Nottawasaga Twp.	June 14/71	3	227	230	
		July 13/71	6	246	252	
		Aug. 18/71	11	225	236	
		May 3/72	10	246	256	
	Lot 33, Con. I Tosorontio Twp.	June 14/71	59	267	326	
		July 13/71	39	221	260	
		Aug. 18/71	41	185	226	
		May 3/72	76	240	316	
	Lot 20, Con. II Sunnidale Twp.	June 14/71	75	185	260	
		July 13/71	70	142	212	
		Aug. 18/71	6	219	225	
		May 3/72	296	326	622	
Nottawasaga River	Lot 25, Con. V Adjala Twp.	June 14/71	95	297	392	
		July 13/71	13	283	296	
		Aug. 18/71	58	223	281	
		May 3/72	61	250	311	
	Lot 5, Con. XII Tecumseth Twp.	June 14/71	21	228	249	
		July 13/71	51	218	269	
		Aug. 18/71	7	210	217	
		May 3/72	83	213	296	
	Lot 16, Con. V Essa Twp.	June 14/71	134	205	339	
		July 13/71	57	213	270	
		Aug. 18/71	—	—	—	Not taken
		May 3/72	65	258	323	
Tributary of Nottawasaga River	Lot 28, Con. I Sunnidale Twp.	June 14/71	138	250	388	
		July 13/71	40	260	300	
		Aug. 18/71	20	192	212	
		May 3/72	106	234	340	
	Lot 9, Con. IX Vespra Twp.	June 14/71	1	197	198	
		July 13/71	33	226	259	
		Aug. 18/71	29	277	306	
		May 3/72	60	271	331	
Pennville Creek	Lot 19, Con. XI Tecumseth Twp.	June 14/71	9	386	395	
		July 13/71	40	374	414	
		Aug. 18/71	5	404	409	
		May 3/72	116	352	468	
Pine River	Lot 17, Con. IV Tosorontio Twp.	June 14/71	62	200	262	
		July 13/71	51	234	285	
		Aug. 18/71	22	168	190	
		May 3/72	53	258	311	
Willow Creek	Lot 21, Con. I Vespra Twp.	June 14/71	100	195	295	
		July 13/71	4	335	339	
		Aug. 18/71	50	262	312	
		May 3/72	18	298	316	
	Lot 10, Con. X Vespra Twp.	June 14/71	34	261	295	
		July 13/71	27	252	279	
		Aug. 18/71	16	247	263	
		May 3/72	111	282	393	
	Lot 11, Con. X Vespra Twp.	June 14/71	—	—	—	Not taken
		July 13/71	31	260	291	
		Aug. 18/71	107	238	345	
		May 3/72	21	387	408	

*PPM — parts per million of weight

5. Water Supply

The watershed as a whole has a reasonable supply of water for most usages. However, shortages were reported in the villages of Creemore, Minesing, and the Beeton Flats.

In Creemore, water shortages sometimes occur in summer months when the supply from spring sources drops and local demand increases. This has resulted in restrictions on lawn and garden watering. In some instances, the situation can be critical, as occurred during a recent fire when the 120,000 gallon reservoir was emptied by fire fighters.

The Village of Minesing has a water system capable of supplying 1,385 gallons per hour. This is sufficient for domestic consumption, but inadequate for lawn and garden watering. A summary of the existing water supply systems in the Nottawasaga area is given in Chapter 2.

The Beeton Flats, an agricultural region, experiences acute seasonal water shortages. The area is traversed by the Bailey, Beeton and Penville Creeks. However, summer flows in these creeks are insufficient for irrigation and livestock watering.

Water shortage in this area could be alleviated by construction of suitable farm ponds throughout the area and by construction of a storage reservoir on Bailey Creek.

6. Pollution

The dictionary definition of pollution is: "the result of being made physically impure, foul or filthy" (The Shorter Oxford Dictionary). Pollution of water is considered to result from any act or circumstance that impairs the water quality of any river, stream, pond, reservoir, well or other body of water. This includes the discharge of material of any kind to the water, or disposing of such material in a way that it may eventually mix with water.

Polluting materials are substances that may be injurious to health, animal or aquatic environment, that render water unsightly to look at or foul to smell, or that interfere with the normal use of waters.

There are three main types of pollution. These are as follows:

i. Organic Pollution

Which, as the name implies, is pollution by any organic substance.

One of the most effective measures of organic pollution is the relation of dissolved oxygen in the water to dissolved oxygen required to stabilize organic waste through the action of aerobic bacteria. This measure is called the *Biochemical Oxygen Demand* or B.O.D. The B.O.D. after a period of five-day incubation at 20 centegrade (68 F), is the commonly-accepted standard of measurement of the oxygen demand.

ii. Bacterial Pollution

This is commonly measured and expressed as the number of coliform bacteria found in a sample of 100-millilitres (ml.). Treated waste should be free of pathogens, including any bacteria, fungi or viruses that may produce disorders or infections of the eye, ear, nose, throat or skin.

iii. Over-enrichment or Eutrophication

This condition results when excessive amounts of phosphorus, nitrogen and certain trace elements are present in water. Eutrophication causes the growth of aquatic vegetation and algal blooms which affect navigation and swimming, and at night withdraw oxygen from the water. Elements that accelerate eutrophication have their main source in household and industrial detergents, and chemical fertilizers, with high phosphate or nitrogen content.

Sources of pollution may be grouped into three major categories; domestic, industrial and agricultural.

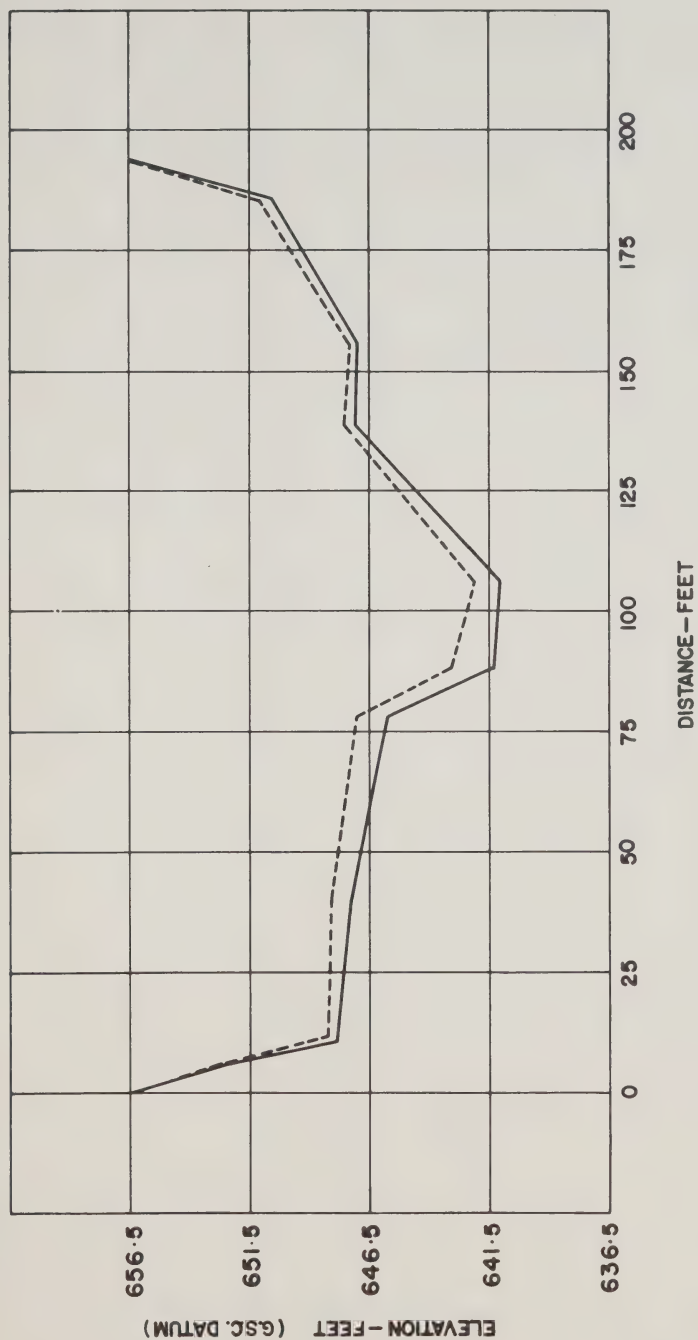


Construction of a grass waterway combined with contour tilling practices would reduce soil erosion in this potato field (Concession I, Essa Township).

A well-maintained grass waterway would reduce field erosion and lower maintenance costs of ditches and culverts. Location — Concession IV, Essa Township.



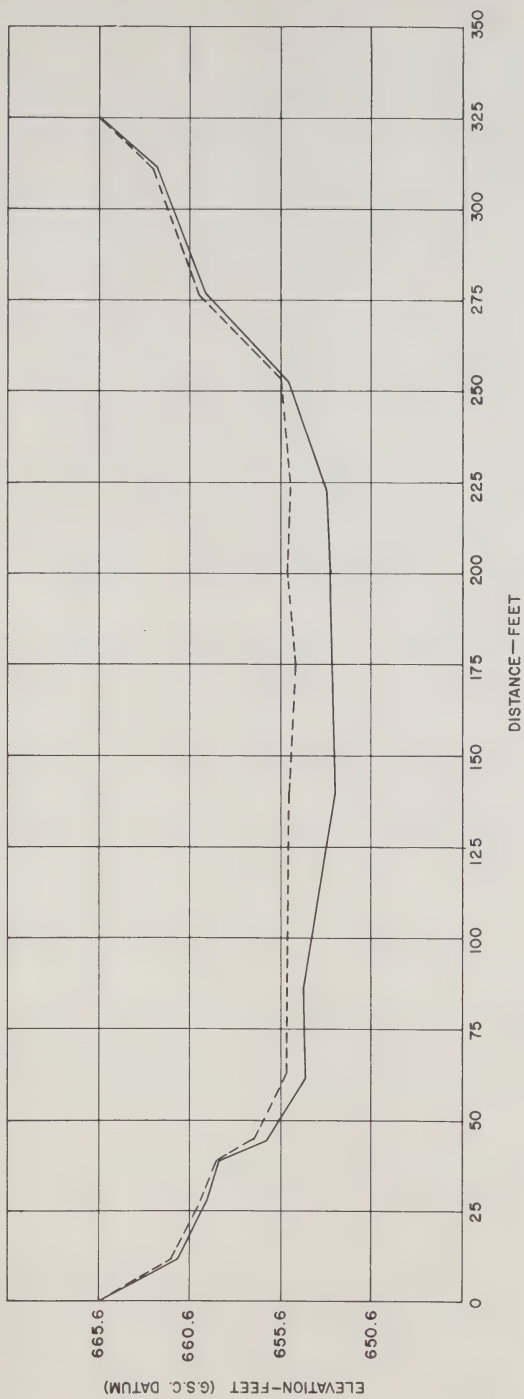
Poor construction practices in ski-slope building resulted in this accelerated soil erosion at a skiing area in Mono Township.



TYPICAL CROSS-SECTION OF UTOPIA RESERVOIR SHOWING SEDIMENT ACCUMULATION

(AS MEASURED IN 1972)

FIG. 3-4



**TYPICAL CROSS-SECTION OF NEW LOWELL RESERVOIR
SHOWING SEDIMENT ACCUMULATION**
(AS MEASURED IN 1972)

FIG. 3-5

a. Domestic

Pollution from domestic sources is usually in the form of waste water from laundromats, individual septic tanks or overloaded municipal waste water treatment plants or lagoons.

In the Nottawasaga area, Beeton Creek, Boyne River, Lamont Creek, Pine River and Georgian Bay are recipients of effluent from treatment plants or lagoons.

Table 3-3 lists the waste treatment systems in operation within the Authority's area together with other pertinent data such as type, capacity, receiving streams, etc. At the time of this study there were a number of townships in the area with substantial populations but no municipal waste water treatment facilities.

b. Industrial

The Nottawasaga Valley area has a very good network for roads and railroads as well as port facilities at Collingwood. In spite of this, industrial growth has been rather slow. Heavy industry is located in Collingwood, and includes ship building and the manufacture of glass, ceramics, furniture, carpets and automotive accessories. Light industries are located at Alliston, Beeton and Shelburne.

The effects of industrial wastes from these areas on nearby receiving streams and water bodies are clearly visible and are already receiving much public attention.

The control and policing of industrial pollution is carried out by the Ontario Ministry of the Environment under the terms of *The Environmental Protection Act, 1971*.

The Environment Ministry's Industrial Wastes Branch pollution control program consists of:

- Routine surveillance of all industries to ensure that they comply with the minimum standards of control or abatement of waste water.
- Review of all waste treatment proposals for new or expanding industries.
- Provision of technical assistance and research to industries for deriving solutions to persistent or unique disposal or waste treatment problems.

The Ministry's current objectives for treated waste water being discharged into natural streams are outlined in the following condensed extracts from its publication "Water Quality Criteria for Recreation and for the Protection of Fish and Wild Life".

Dissolved Materials

Discharged materials may not increase the concentration of dissolved solids by more than 1/3 of the natural amount present in the receiving water.

Alkalinity, Acidity, pH

1. Acids may not be added in quantity that would lower the total alkalinity of the water to less than 20 mg/l.
2. The range of pH should be kept between 6.5 and 8.5

Temperature

Heated water may not be discharged in the vicinity of spawning areas, or where water temperatures might interfere with recognized movements of the spawning or migrating fish population.

Dissolved Oxygen

1. In warm water Biota, the D.O. should be above 5 mg/l at all times. In some conditions when all other factors are favourable, the concentration may be as low as 4 to 5 mg/l for short periods within the span of 24 hours.

TABLE 3-3
WASTE TREATMENT SYSTEMS

Community	Type	Capacity MGD *	Population Served	Type of Treatment	Outfall Receiving Stream	Present Flow MGD *
Alliston	Custom built extended aeration plant	0.77	3,233	Grit chambers Aeration & chlorine	Boyne River	0.4
Base Borden – Angus	Primary Plant	4.5	10,000	Chlorination Digesters Grit chambers	Pine River	0.85
Beeton	2 celled 14.8 acre lagoon system	0.14	600		Beeton Creek	N.A.
Collingwood	Primary treatment plant	4.2	9,300 (approx.)	Grit tanks Barninutors Primary settling tanks Chlorination Digesters	Georgian Bay	N.A.
Cookstown Estates (Private)	2 celled 5 acre lagoons and sprayers	0.02	400 (approx.)		None	
Shelburne	2 celled 13.2 acre lagoons	0.13	1,948		Tributary of Boyne River	0.2
Stayner	2 celled 20 acre lagoons	0.2	2,160		Lamont Creek	0.06
Tottenham	2 celled 14 acre lagoons	0.2	1,300		Beeton Creek	Seasonal flow only

*MGD -- Million Gallons per Day
N.A. -- Not Available

Data from Ministry of the Environment

2. In cold water Biota, the D.O. may not be below 7 mg/l at any time in the spawning areas. Elsewhere, the D.O. should not drop below 6 mg/l. When otherwise favourable conditions prevail, it may be between 6 mg/l and 5 mg/l for a short time within a 24-hour period.

Carbon Dioxide

The "free" carbon dioxide concentration should not exceed 25 mg/l.

Plant Nutrients and Nuisance Growths

1. Nutrients from unnatural sources that will stimulate the production of algae, nuisance vegetation, or offensive slime growths, should not be added.
2. Organic or other materials that will promote an increased form of anaerobic decomposition in water should not be permitted to enter it.
3. The naturally-occurring ratios of nitrogen (NO_3 and NH_4) to total phosphorus should not be upset by wastes or by land drainage.

Toxic Substances

Toxic substances must not be added to water in concentrations of combinations that are toxic or harmful to human, plant, animal or aquatic life, except for approved control of aquatic nuisance organisms.

A more detailed list of undesirable materials and technical data can be obtained from the Ministry of the Environment, Water Quality Division.

c. Agricultural

The chief polluting elements from agricultural sources are:

- livestock and poultry wastes
- dead and decomposing farm or wild animals
- residues of pesticides and chemical fertilizers
- crop residues

Traditionally, farms were not thought of as a source of either air or water pollution because farming by-products and wastes were often recycled as fertilizers on cultivated fields.

Modern, large scale production methods of beef cattle, swine, turkeys and broiler chickens has encouraged the rearing of large numbers of animals and birds on smaller farms where disposal of the increased volume of wastes by former methods is not always possible. The availability of cheaper and more convenient chemical fertilizers has also lessened reliance on recycled agricultural wastes.

Difficulties in disposal of animal wastes are reflected in studies showing that 500,000 broilers (chickens), 50,000 laying hens, 5,000 market hogs, 1,000 beef cattle or 500 dairy cattle, separately produce manurial waste equal to the domestic wastes generated by a community of 10,000 people.

The biochemical oxygen demand (B.O.D.) of animal manure is very high. When these wastes are allowed to enter streams, they cause oxygen depletion resulting in fish kills and long term ecological changes in water.

Chemical fertilizers become pollutants when they find their way into rivers and streams. This they do in the following ways:

- leaching through the soil to ground water
- being carried in solution or adhering to soil carried to streams by surface run-off.

The results of the preliminary analysis of the water samples taken at selected locations in the Nottawasaga watershed by the staff of the Ministry of the Environment in 1971 and 1972 are given in Table 3-4.

7. Irrigation

The need for irrigation arises from lack of sufficient water to grow crops. Over the year as a whole the Nottawasaga Valley does not suffer from an inadequate water supply. At the Beeton Meteorological Station, for example, the mean yearly precipitation is 30.83 inches for a period of 25 years, an amount that is more than sufficient to cover the average yearly crop requirement of 23 inches. At the Angus Meteorological Station, the yearly mean total precipitation is 31.34 inches for a period of 30 years. The main problem lies in the distribution of the rainfall during the year. For example, of the 31.34 inches, an average of 16.94 inches fell during the growing season between May and October. Because of this deficit, a number of farms have embarked on irrigation programs to increase yield. This is particularly so among the sod and potato farms in the watershed, especially in the Beeton Flats area, and in Tecumseth and Adjala Townships, and in the case of tobacco growing which relies almost exclusively on irrigation for successful crops. In 1961, about 96 farms were growing tobacco. Most of these were in the area of New Lowell, Angus and Alliston.

There is sufficient evidence to show that farming operations would be more successful if irrigation was improved.

A recent survey by James F. MacLaren Ltd., Consulting Engineers, revealed that over 1300 acres were irrigated during 1970 in the Beeton Flats, and that several hundred additional acres would be irrigated if more water was available.

Table 3-5 shows existing water-taking permits for quantities in excess of 10,000 gallons per day, issued as of March 30, 1972 by the Water Quality Management Branch, Ministry of the Environment.

The table also shows that the greatest demand for irrigation water is on the Innisfil — Bailey — Beeton Creeks system, where an average minimum of 0.17 acre-feet per day is taken for each square mile of the drainage area.

This amount is 70% higher than the demand for irrigation water within the total area of the Authority, which has an average minimum demand of 0.10 acre-feet per day per square mile.

Despite the demand for irrigation water, there are no storage reservoirs of any consequence located in the Innisfil or Bailey Creek drainage basins, and, as far as can be ascertained, the one reservoir on Beeton Creek, located at Tottenham, is not used for irrigation. As of March 30, 1972, MOE had issued 138 irrigation permits, including some with special conditions.

Of these, 41 were for tobacco, 23 for potato, 13 for sod, 5 for golf courses and 5 for market garden vegetables and nursery stock.

Field surveys showed that there were other water users without permits. However, due to great variations in quantities taken, no attempt was made to estimate the total consumption.

To determine the effectiveness of any contemplated irrigation scheme, several factors would need to be studied, including:

- amount of precipitation and its distribution over the area of concern
- soil type, its fertility and ability to retain moisture
- methods of cultivation
- estimates of evapotranspiration
- source and availability of water for irrigation

The Utopia Dam and Reservoir from the North embankment. Multi-purpose reservoirs enhance water management by providing recreational facilities and water for low flow augmentation.



Dam and reservoir at Tottenham. Rehabilitation of older structures provides added benefits.

This pond in Concession I, Mulmur Township, is typical of the many ponds throughout the headwater regions of the principal rivers in the Nottawasaga Watershed.



TABLE 3-4
WATER QUALITY DATA

Sample Number	Date	Total Coliform	Fecal Coliform	Fecal Strep. Coliform	Diss. Oxyg. mg/l	BOD5 mg/l	Chloride mg/l
BOYNE RIVER AT EARL ROWE PARK							
2178	March 8/71	500	—	—	6.0	0.5	15
331	April 4/71	7,800	—	—	12.0	1.6	8
430	May 10/71	200	—	—	9.0	0.8	8
2573	June 7/71	710	—	—	9.0	1.8	18
2692	July 6/71	28	—	—	14.0	1.4	10
2746	Aug. 3/71	256	—	—	8.0	2.5	30
1004	Oct. 5/71	180	—	—	9.6	1.4	9
3043	Nov. 1/71	148	—	—	9.0	1.8	11
1180	Nov. 9/71	112	—	—	7.7	0.8	10
78	Jan. 17/72	60	20	—	11.2	0.5	13
194	Feb. 21/72	356	12	1	11.0	—	—
2164	March 13/72	280	4	—	10.2	1.0	14
284	April 10/72	1,000	4	4	—	1.2	19
368	May 8/72	84	20	28	9.6	0.8	10
459	June 5/72	232	4	1	7.8	1.0	12
2562	July 11/72	152	1	1	7.9	2.0	12
2609	Aug. 8/72	128	4	4	8.1	—	—
BOYNE RIVER AT ALLISTON							
2177	March 8/71	13,000	—	—	8.0	1.4	19
330	April 3/71	9,500	—	—	11.0	1.8	8
429	May 10/71	7,200	—	—	9.5	1.2	11
2572	June 7/71	35,000,000	—	—	8.0	4.5	58
2691	July 6/71	47,000	—	—	11.0	9.0	20
2878	Aug. 10/71	2,600	—	—	8.0	1.6	14
2745	Aug. 3/71	12,100	—	—	9.0	2.5	19
1003	Oct. 5/71	7,500	—	—	7.2	3.0	21
3042	Nov. 1/71	292	—	—	8.0	1.8	17
1179	Nov. 9/71	13,000	—	—	7.0	1.0	14
77	Jan. 17/72	3,000	1,000	—	9.4	2.0	18
193	Feb. 21/72	240,000	6,500	600	9.9	—	—
2163	March 13/72	14,000	8	—	7.8	1.4	18
283	April 10/72	110,000	900	270	13.0	4.8	23
367	May 8/72	10,900	172	144	9.4	1.6	12
458	June 6/72	1,600	1	1	7.8	1.6	14
2561	July 11/72	13,500	2,200	168	7.6	2.0	15
2606	Aug. 8/72	36,000	756	41	7.2	—	—
BOYNE RIVER AT HWY. 24, NORTH OF SHELBURNE							
2612	Aug. 8/72	450,000	2106	600G	7.1	—	—
BOYNE RIVER DOWNSTREAM OF HWY. 24 AT SHELBURNE							
2613	Aug. 8/72	444	64	124	9.4	—	—

TABLE 3-4 – WATER QUALITY DATA – *continued*

Sample Number	Date	Total Coliform	Fecal Coliform	Fecal Strep. Coliform	Diss. Oxyg. mg/l	BOD5 mg/l	Chloride mg/l
PINE RIVER UPSTREAM OF BASE BORDEN TREATMENT PLANT							
2180	March 8/71	136	—	—	10.0	0.8	7
332	April 3/71	284	—	—	10.5	1.0	4
431	May 10/71	44	—	—	10.0	0.4	8
2583	June 7/71	2,900	—	—	8.0	1.2	12
2693	July 6/71	484	—	—	10.0	0.6	7
2880	Aug. 10/71	288	—	—	9.0	0.6	7
2747	Aug. 3/71	276	—	—	9.0	1.0	15
1005	Oct. 5/71	292	—	—	9.7	0.8	5
3044	Nov. 1/71	24	—	—	9.0	1.2	8
1181	Nov. 9/71	192	—	—	7.4	0.5	6
79	Jan. 17/72	40	4	—	9.6	0.5	6
195	Feb. 21/72	28	4	1	10.2	—	—
2165	March 13/72	220	4	—	7.7	0.5	4
285	April 10/72	370	8	4	12.4	1.2	6
369	May 8/72	100	1	8	9.4	0.8	7
460	June 5/72	44	20	4	8.7	0.6	8
2563	July 11/72	276	84	24	8.7	1.4	8
2608	Aug. 8/72	364	204	164	8.4	—	—
PINE RIVER, UPSTREAM OF THE NOTTAWASAGA RIVER CONFLUENCE							
286	April 10/72	1,800	12	4	12.0	1.4	8
370	May 8/72	7,500	36	1	9.3	1.0	8
461	June 5/72	212	8	4	8.6	1.4	8
2564	July 11/72	220,000	1,200	20	8.0	2.5	8
2607	Aug. 8/72	13,500	80	44	8.2	—	—
NOTTAWASAGA RIVER AT HWY. 92, WASAGA BEACH							
2181	March 8/71	320	—	—	10.0	0.5	13
334	April 3/71	272	—	—	10.5	1.4	8
433	May 1/71	8	—	—	9.0	0.6	9
2596	June 8/71	116	—	—	9.0	3.0	11
2715	July 7/71	80	—	—	13.0	2.5	9
2769	Aug. 4/71	108	—	—	8.0	3.5	9
2902	Sept. 1/71	1,900	—	—	9.0	1.4	8
1007	Oct. 5/71	152	—	—	8.0	1.4	7
3066	Nov. 3/71	52	—	—	8.0	1.4	10
1185	Nov. 9/71	1,200	—	—	7.9	0.5	9
81	Jan. 17/72	2,100	72	—	7.8	1.0	12
197	Feb. 21/72	256	168	4	7.6	—	—
2167	March 13/72	7,000	4	—	—	1.0	9
288	April 10/72	900	4	8	9.0	3.8	13
391	May 10/72	500	4	4	8.5	1.2	10
486	June 7/72	130	4	4	8.4	2.6	8
2589	July 12/72	300	4	28	8.0	—	—
2623	Aug. 9/72	3,400	8	140	9.4	—	—
BEETON CREEK, DOWNSTREAM OF THE VILLAGE OF BEETON							
2610	Aug. 8/72	2,600	188	120	8.5	—	—
BEETON CREEK, DOWNSTREAM OF THE VILLAGE OF BEETON							
2611	Aug. 8/72	5,200	256	136	8.3	—	—

TABLE 3 - 5
WATER TAKINGS

Drainage System	Purpose of Water Taking	Number of Permits	Estimated Quantity Taken MGD**	Estimated Quantity in AC-Ft*** /day	Total Amount of Water Taken per day
Nottawasaga River	Golf course Irrigation	2	0.117	0.431	
	Sod farm Irrigation	2	1.296	4.774	14.722 MG
	Miscellaneous Use	28	13.309	49.026	54.231 Ac-Ft.
Boyne River	Golf course Irrigation	1	0.052	0.191	
	Sod farm Irrigation	2	.984	3.625	4.443 MG
	Miscellaneous Use	8	3.407	12.550	16.366 Ac-Ft.
Mad River	Miscellaneous Use	13	4.292	15.810	4.292 MG 15.810 Ac-Ft.
Willow Creek	Golf course Irrigation	1	0.382	1.407	0.852 MG
	Miscellaneous Use	2	0.470	1.731	3.138 Ac-Ft
Innisfil – Bailey Beeton Creek	Sod farm Irrigation	6	2.510	9.246	8.089 MG
	Miscellaneous Use	18	5.579	20.551	29.797 Ac-Ft.
Pine River	Miscellaneous Use	5	1.109	4.085	1.109 MG 4.085 Ac-Ft.

Total quantity of water taken within the boundaries of the Authority for any given day in season = 33.507 MG
123.427 Ac-Ft.

*GPM – Gallons Per Minute

**Million Gallons Per Day

***Ac-Ft. – Acre-Feet

NOTE: Permits are required for quantities in excess of 10,000 gallons per day.

Special permits for certain periods of the year are also issued. These are not included in this table.

SOURCE: Ministry of the Environment

Chapter 4

NEEDS AND REMEDIAL MEASURES

1. Watershed Protection and Management

Watershed management has been defined as:

“The art and science of managing the land, vegetation and water resources of a watershed for development, use, control and protection of its water resources for the benefit of Man”.

The water shortages and excesses that have been experienced in the Nottawasaga Valley are the clearest indicators of the need that exists for comprehensive and concentrated watershed management.

There is great demand by industry and recreation for surface water. The increase in recreational demand has been particularly dramatic in the past few years. Growing demand in turn requires effective measures for conservation and utilization of water resources.

Intelligent management would include comprehensive knowledge of the qualitative and quantitative availability of water and proximity to potential users. This information could be obtained through a comprehensive gauging system on all major rivers and streams, together with a network of rain gauges and snow survey courses.

Figure 1-1 shows the recommended locations of streamflow and precipitation gauges within the watershed.

2. Water Quality Control

One of the major goals of the Conservation Authority should be to see that all natural watercourses within its jurisdiction remain free of pollution.

The Conservation Authority should implement a widespread and continuing program of public education concerning the nature and effects of pollution. Farmers particularly need to be informed about agricultural pollution, especially from animal wastes, fertilizers and chemicals, and to be advised about the penalties for infringements of the Ontario Water Resources Act. For the reasons discussed in Chapter Three, they should also be encouraged to use other means of watering their livestock than allowing them unrestricted access to streams, and to fence the streambanks wherever possible.

The Authority should work closely with the Ministry of the Environment in detecting and reporting sources of pollution. Alliston is a special area of concern as coliform counts as high as 35,000,000 per ml were recorded there.

The Environmental Protection Act and its enforcement provisions against polluters should receive the active support of the Authority.

3. Flood Prevention and Water Conservation

Spring floods resulting from snowmelt, rain and ice jams, either separately or in combination, are more frequent and widespread, and generally cause more damage than summer and fall floods. However, the latter always remain a threat, particularly on smaller streams. Hurricane-type storms which may take place in late summer and early fall often produce heavy rainfall that results in flooding. This was most clearly demonstrated in October, 1954, when Hurricane Hazel caused catastrophe throughout much of South Central Ontario.

Any direct or indirect method of reducing damages from flooding may be considered a flood control measure. A number of proven methods of flood control are commonly used, and their applications to specific areas are as follows:

a. Flood Plain Zoning and Acquisition

One of the simplest ways of reducing flood damage is through land-use management that restricts or controls development in flood-prone areas. Limiting the use of flood plains by zoning requires the co-operation of municipalities. There are three important areas to be considered in the preparation of zoning plans or acquisition programs:

i. Floodways

Channels of rivers or streams and those portions of adjacent flats which are required to carry and discharge flood flows resulting on those rivers and streams from the occurrence of a specific design storm.

ii. Flood Plain Lands

The areas adjoining rivers or streams which have been or may be subjected to flooding.

iii. Conservation Lands

The buffer zones between the limits of the design floodways and private lands. Where a valley is well defined, it is preferable to acquire lands to the top of the valley slopes to protect private property and buildings from damage in the event of slope failures which occur frequently and often without any warning. This buffer also provides added protection against further encroachment onto the flood plain lands. These areas or zones are graphically illustrated in Figure 4-1.

River valleys are not all well defined in the Nottawasaga area. This is especially true within the Minesing Flats, the Beeton Flats and the lower parts of the flood plain of the Pretty River near Collingwood. Fortunately, the Authority has already taken action to acquire these areas or provide the required protection to alleviate the flooding and hazard to life.

Under the Conservation Authorities Act and subject to approval of the lieutenant-governor in Council, the Authority has the power to pass regulations to prohibit any building on lands subject to flooding from a regional storm.

The definition of the regional storm for the streams of the Nottawasaga Valley Conservation Authority is based on a "Timmins Storm" type rainfall occurring over the watershed.

Flood line mapping was carried out on some reaches of the Mad River, Pine River and Innisfil and Black Ash Creeks and the extent of flood lining is shown on Figure 3-1. Additional flood line information is on file with the Conservation Authorities Branch.

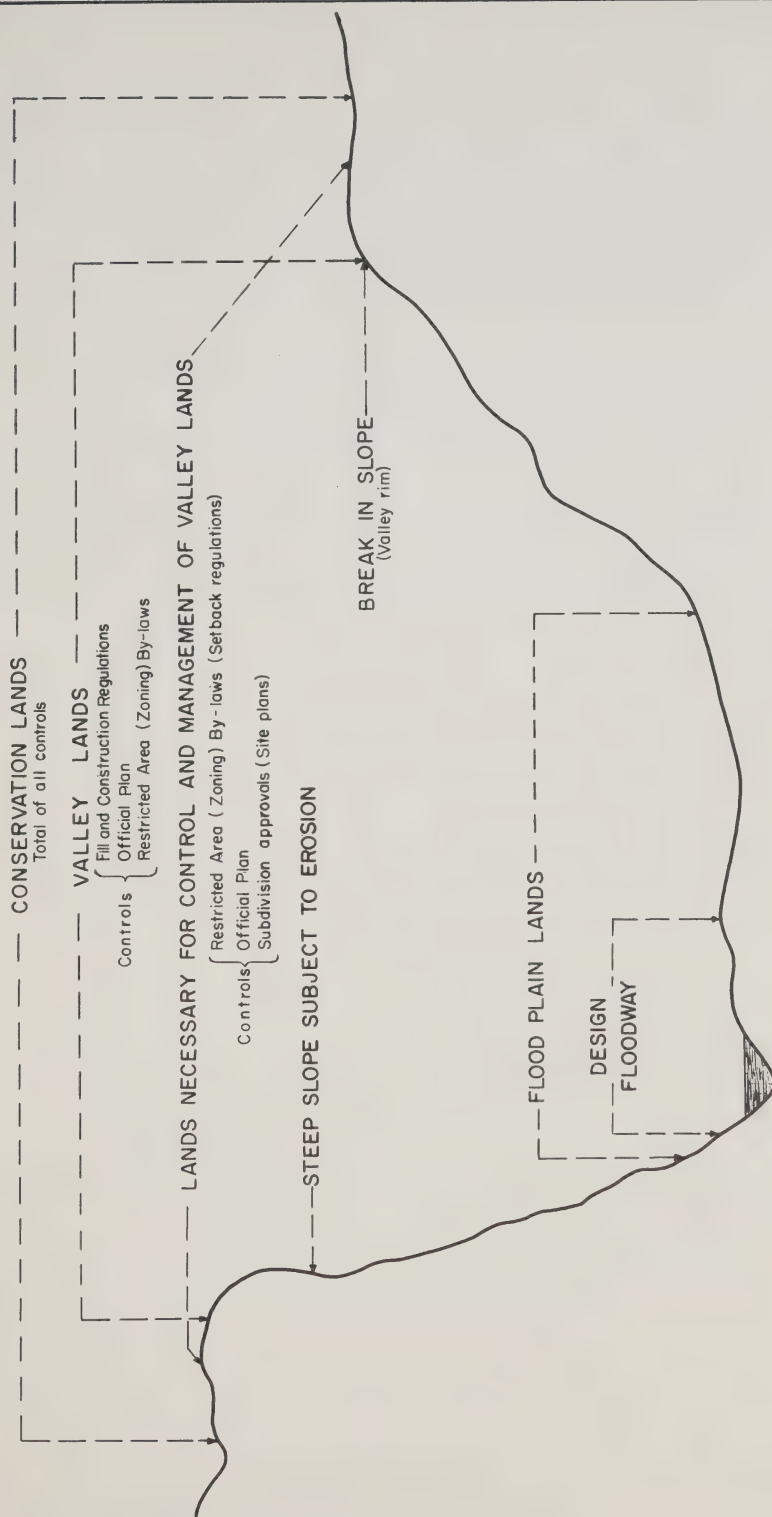
This information should be periodically reviewed and updated, and should always be supported with zoning controls, or fill and construction regulations. If the flood plain is occupied by permanent and valuable structures whose relocation would be impractical, then flood control measures must be provided to alleviate or minimize damage. These can be one or more of the following types:

b. Channel Improvement

On some streams, deepening, widening and straightening the stream channel, combined with the enlarging of the bridges, lessen the severity of flooding. Benefits from this type of remedial measure, however, are confined to the improved section of the stream and a short distance upstream. Nevertheless, it accomplishes the purpose of safely discharging high flows past flood-vulnerable areas. This method would probably be the most practical solution for the flood problem at Lisle.

c. Diversion

In some cases, flood damages may be prevented by diverting the flood flows from a normal channel into an artificial or another natural channel and away from the area requiring protection. In some instances, it may be possible to divert the excess water to another watershed.



TYPICAL CROSS SECTION OF A RIVER VALLEY
AND POSSIBLE LAND-USE CONTROLS

FIG. 4-1

d. Dyking

Dyking may be resorted to on most streams to control flooding, but carries the risk of increased flood damages upstream and downstream of the protected reach of the river. For this reason, dyking is regarded as a substitute method to be used where other methods are not practical or where some immediate relief is necessary. Care must be taken to ensure that flood conditions above and below the protected zone are not aggravated. The Town of Collingwood has undertaken the construction of dykes along the reach of the Pretty River through the town to prevent flooding. Estimated cost of this scheme is about \$800,000.

e. Flood Proofing

The adjustments made to property, buildings or their contents to prevent or reduce damages by flooding are referred to as flood proofing. This method is employed mostly by property owners as a last resort, when there is not sufficient support to proceed with a project to provide some more permanent protection to the overall area.

f. Reservoirs

Where practical, flood protection by means of a dam and reservoir is the preferred method as it provides for use of otherwise surplus water. Because of the opportunities for multiple use, reservoirs have achieved an important role in water management programs. Reservoirs may vary in size and may be designed to provide any or all of the following benefits:

- flood control
- low flow augmentation
- recreation
- fish habitat and wildlife enhancement
- water supply for agricultural, domestic or fire protection purposes

In order to provide flood control benefits, a reservoir must satisfy two basic criteria:

Firstly, it must be strategically located to control the run-off from a significant portion of the drainage area above the community or area to be protected.

Secondly, it must possess storage capacity large enough to significantly reduce the flood peak occurring above the area requiring flood protection.

Five dam and reservoir sites were investigated during the survey, but none of these could be justified on the basis of flood protection alone. Field investigations were necessarily preliminary in nature and no soil studies were carried out. For these reasons, further engineering would be required to determine whether any justification exists for developing these sites on the basis of flood control, low flow augmentation, recreation, etc.

g. Flood Warning System

Apart from these flood control measures, the Authority should develop a flood warning system. The establishment of rain and stream gauges would make available a good basic data collection system for flood warning purposes. The Authority should establish contact with all gauge observers on the watershed. During critical periods, the observers would then be expected to supply the Authority with rainfall and streamflow data which in turn would be forwarded to the Conservation Authorities Branch to assist in the development of flood forecasts.

Flood forecasts are issued as required to Authority personnel and to the public by means of radio and television broadcasts. Flood warning is primarily for the purpose of removing property from the reach of rising flood waters but is also used to determine whether the impending danger warrants evacuation of critical areas.

The warning system should include the operators of publicly-owned dams as well as the owners of some of the larger private dams. In addition to providing effective protection to residents downstream, such a comprehensive system would promote co-ordinated operation of dams and therefore minimize flood damages by improved control of high flows.

The system in its first stage should include the operators of the following five dams; New Lowell, Tottenham, Earl Rowe, Singhampton and Utopia.

In the meantime, other strategically located privately owned dams should be investigated with a view to inclusion in the system.

4. Ponds

The need for water supply sources and efforts to preserve the available surface water are reflected in the large number of ponds and small reservoirs existing in the watershed, especially in the drainage area of the upper reaches of the Boyne, Pine, Mad and Nottawasaga Rivers.

The ponds, although different in size and design, serve the purpose of providing water for recreation, fishing, watering of livestock, irrigation and fire protection.

The majority of ponds inspected were the dug out or spring-fed type, while others were flow-through or by-pass type, having a stream as the source of water supply. Figures 4-2 and 4-3 illustrate pond types.

The Authority should encourage and promote the construction of ponds by providing technical assistance directly, or by advising interested persons of the assistance available from the Ontario Ministry of Agriculture and Food. Private owners wishing to construct a pond, particularly one requiring the construction of a dam on a permanent watercourse, must be made aware of the requirements of the Lakes and Rivers Improvement Act.

Proposed sites should be investigated carefully to ensure that the building of a pond would not impair the quality of water in the stream or hamper the movement of migratory fish.



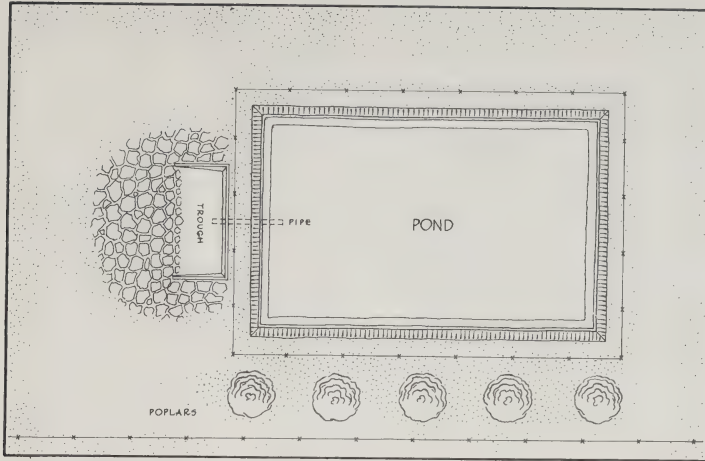
Downstream view of dam spillway on the Boyne River, Mulmur Township. Fish ladders in these structures would encourage fish migration.

Downstream view of dam on the Mad River at Singhampton. Such privately owned dams could be advantageously incorporated into a flood-warning system.

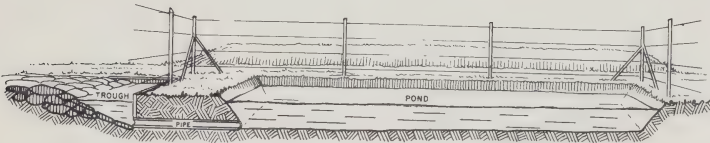


Remains of a former dam on Bailey Creek near Keenansville. A new dam and reservoir just upstream from this site would provide additional summer flow as well as recreational facilities.

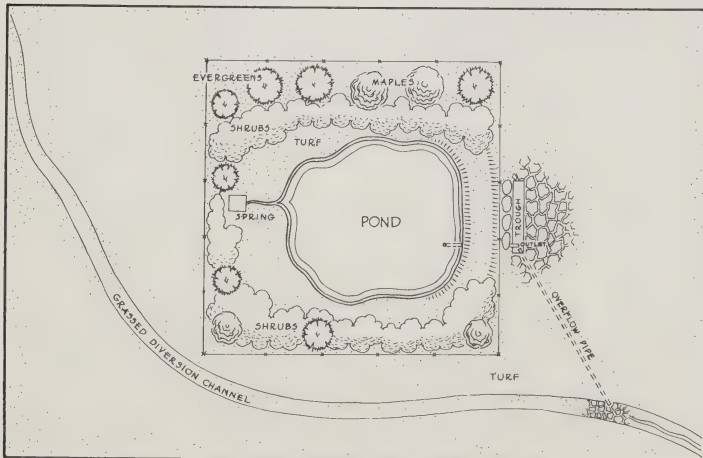
TYPICAL PONDS



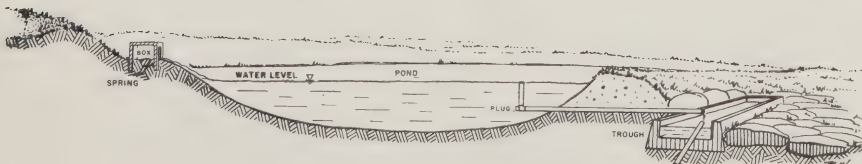
PLAN OF DUG-OUT POND



SECTION OF DUG-OUT POND

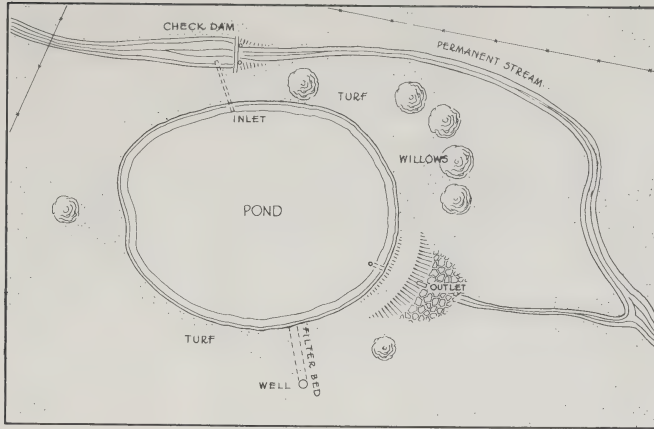


PLAN OF SPRING-FED POND

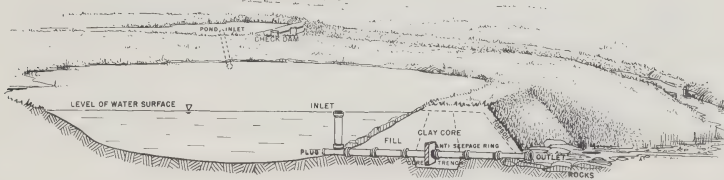


SECTION OF SPRING-FED POND

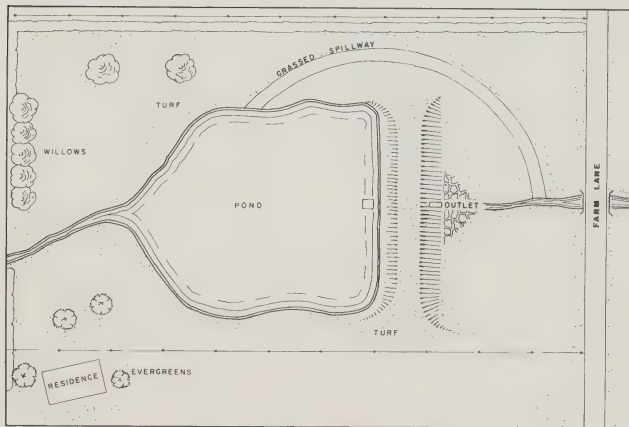
TYPICAL PONDS



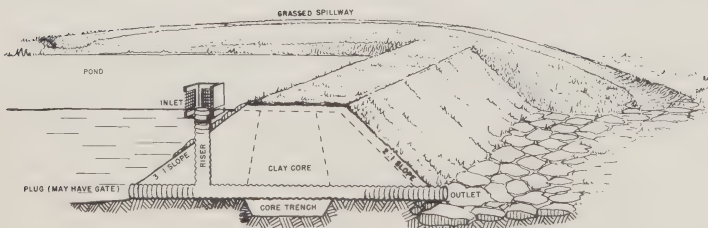
PLAN OF BY-PASS POND



SECTION OF BY-PASS POND



PLAN OF RUN-OFF POND



SECTION OF RUN-OFF POND

Chapter 5

CONSERVATION PLAN

1. Purpose

The purpose of the Conservation Plan is to provide the Nottawasaga Valley Conservation Authority with a set of objectives. These are designed to implement the recommendations of this report within both a reasonable time period and the financial capabilities of the participating municipalities. The Conservation Plan is intended to:

- a. Define policy to guide the Authority in exercising its powers under the Conservation Authorities Act.
- b. Provide for the orderly implementation of measures intended to ensure the maximum benefit to society of the land, water, forest, wildlife and recreational assets of the Nottawasaga Valley.
- c. Provide a basic framework within which more detailed conservation planning can take place.
- d. Ensure stable budgeting by the Authority and the participating municipalities.
- e. Provide policy guidelines and direction input into other planning processes initiated by other public agencies or member municipalities.
- f. Assist in the integration of Authority action with that of other agencies to achieve the most effective and economical total conservation program for the Nottawasaga Valley.

2. Basis

The Basis of the Conservation Plan is founded on the results of the studies and analyses of data which were carried out by the Conservation Authorities Branch of the Ministry of Natural Resources. Details of some of these studies are contained in the preceding section of this report. The following therefore form the basis of the Conservation Plan:

- a. The Nottawasaga Valley Conservation Authority is an area composed of municipalities with separate jurisdictions, yet to some degree dependent on one another, and all closely associated with the natural resources of the watershed.
- b. Urban development will continue, especially along the eastern and northern periphery of the watershed. Permanent rural non-farm development in the Authority will be concentrated in Mono and Mulmur Townships and the southern part of Nottawasaga Township.
- c. Demands for cottage sites and winter recreational opportunities will be concentrated along the shores of Georgian Bay as well as in the Collingwood Blue Mountain area.
- d. The Authority's resource objectives can be carried out successfully only if member municipalities co-operate by adopting land use regulations such as subdivision policies, zoning by-laws, and Official Plans, which are consistent with the aims and policies of the Authority.
- e. The activities of the Authority will be closely co-ordinated with those of other resource agencies of the local, federal and provincial governments.
- f. The multi-purpose principle will govern in the planning and development of Authority projects and programs.
- g. The Authority will organize its activities so as to stimulate public interest and promote participation by individuals and local groups in conservation projects.
- h. The Authority will receive sufficient local municipal support to carry out a satisfactory conservation program.

3. Development Policy

In order to proceed with a successful development plan, the Authority needs to formulate and adopt a clear statement of policies. A suitable policy statement would be as follows:

General

The general policies guiding future developments of the Nottawasaga Valley Conservation Authority are:

1. Management of all existing natural resources will be compatible with the needs and demands of the people of the municipalities.
2. The Authority will encourage municipalities and planning boards to adopt land-use regulations, and will endeavour to have policies reflecting the aims of the Authority incorporated in these regulations.
3. The Authority will prepare and register fill and construction regulations under the provisions of Section 27 of the Conservation Authorities Act, and co-ordinate these regulations with Official Plans and zoning by-laws. Top priority will be given to urban or suburban areas.
4. The Authority will include in its program of resources management the preservation of the natural environment, including areas of natural, scenic, biological and historic interest.
5. The Authority will establish an active educational program, maintaining communication with all the people of the watershed, publicizing its aims and objectives and the availability of technical and financial assistance. This will involve meetings, displays and publications to show the technical, integrative and financial roles of the Authority in the maintenance and enhancement of those amenities which sustain and contribute to a pleasant environment within which to live, work, and play.

Water Development

Water development programs will be governed by the following policies:

Streamflow and water conservation

1. The Authority will ensure by all means in its power the maintenance of adequate streamflow, by means of dams or other methods that are required to preserve and enhance the quality and usefulness of the streams and rivers.
2. The Authority will encourage the construction of ponds to provide water for recreation, irrigation, the watering of livestock and low flow augmentation.
3. The Authority will participate in a stream-gauging program, in co-operation with the appropriate agencies.

Water Quality

1. The Authority will establish a supplementary water sampling program in co-operation with the Ministry of the Environment, to locate the sources that impair the water quality of streams or reservoirs.

Sediment Control

1. The Authority will undertake a publicity program on the need for proper land-use and construction practices to reduce the siltation of stream channels and drainage courses.
2. The Authority will undertake a program to install, where feasible, sediment and debris traps to protect its reservoirs from sedimentation.

3. The Authority will undertake a program to measure the accumulation of sediment in its reservoirs, and reservoirs that are part of the flood control system.
4. The Authority will undertake a program to protect streambanks from accelerated erosion.

Channel Improvements

1. Flood-vulnerable sections of urban areas will be protected by the construction of channel improvements only if other methods of flood protection are not feasible.
2. Channel improvements and associated structures will be so designed as to discharge design flows and withstand high velocities without adverse effects.
3. Lands necessary for access to and the construction of channel improvements will be acquired or otherwise controlled by the Authority, in order to prevent the possibility of interference with the development and maintenance of these projects.

Land-Use Regulations

1. Action will be taken to restrict the use of flood-prone areas, valley slopes and shorelines, as well as hazard lands, to such non-intensive uses as agriculture, parks, recreation or wildlife sanctuaries, through regulations pursuant to Section 27 of the Conservation Authorities Act, and through co-operation with municipalities in control of zoning development.

4. Development Priorities

Priorities will be established after due consideration of the background studies carried out by the Conservation Authorities Branch, the development policies of Section 3, and the financial capabilities of the Authority. The priorities cover a ten-year period, although they can be extended to form part of a broader, long-range program. The priorities will be adjusted from time to time to suit conditions and will be subjected to a complete review every five years. The priorities will be established in conjunction with the following figures in this report:

Figure 1-1 Surface Water Resources

Figure A-3 Flood plain of Pine River in Angus

Figure A-2 Flood plain of Black Ash Creek in Collingwood

Figure A-1 Flood plain of Innisfil Creek near Cookstown

Figure A-4 Flood plain of Mad River in Angus

Figure 3-2 Flood plain of the Nottawasaga River System in the Minesing Flats

Figure 4-1 Typical cross-section of a river valley and possible land-use controls

Figure 3-3 Stream-bank erosion problems

Figure 3-4 Typical cross-section of the Utopia Reservoir showing sediment accumulation

Figure 3-5 Typical cross-section of the New Lowell Reservoir showing sediment accumulation

The text in Section 1, Part 3, outlining the importance of the removal of dead elm trees from the floodplains of rivers and streams will also be studied with a view to establishment of a priority item.

5. Detailed Conservation and Development Program Recommendations for the 1970's

- a. To ensure protection from future flood damage, it is recommended that the Authority complete the dyke project along the Pretty River in Collingwood as soon as possible.

- b. It is recommended that the Authority initiate flood plain mapping along Silver Creek near Collingwood, and along the stream at the westerly edge of Cookstown before further building takes place on flood-prone areas. It is further recommended that fill and flood plain regulations, under Section 27 of The Conservation Authorities Act, be filed at once for the flood plains of Black Ash Creek at Collingwood, the Pine and Mad Rivers at Angus, and the flood plain of Innisfil Creek in Innisfil Township.
- c. It is recommended that the Authority undertake a feasibility and benefit-cost study of the potential reservoir site on the Noisy River at Maple Valley, to determine its potential for flood control and recreation.
- d. It is recommended that the Authority undertake a feasibility and benefit-cost study of the potential reservoir site on Bailey Creek near Keenansville, to establish the value for limited flood protection, low flow augmentation and irrigation.
- e. It is recommended that the Authority undertake a feasibility and benefit-cost study of the potential reservoir site on the Mad River near Singhampton.
- f. It is recommended that the Authority initiate a dead elm tree removal program to protect river banks from further erosion and to lesser existing flood problems. Clearing of the flood plains in the headwater region of the Nottawasaga River, the Mad River and the Pine River should receive immediate attention.
- g. It is recommended that the Authority's land acquisition program in the Minesing flats area be reviewed and additional lands be scheduled for acquisition. This should be based on Figure 3-2, indicating the limits of 1972 spring flooding as it affected the Minesing flats.
- h. In order to enhance effective watershed management, it is recommended that the Authority install recording stream gauges at locations shown on the Surface Water Resources Map.
- i. To ensure maintenance of water quality, it is recommended that the Authority co-operate with the Ministry of the Environment by taking water samples for chemical and biological analysis, and determination of the amount of suspended solids in streams.
- j. It is recommended that the Authority ensure through its water-sampling program that the water quality of the outfall from industrial lagoons does not fall below that which is processed through municipal pollution control plants.
- k. To evaluate the useful storage of reservoirs operated by the Authority and reservoirs considered to be part of the flood control system, it is recommended that reservoirs be examined from time to time for silt accumulation and that measures be taken to reduce the accumulation when necessary.
- l. To lessen the widespread problem of streambank erosion, it is recommended that the Authority undertake a pilot program for streambank protection. This project should initially be concentrated on the Bear Creek and Coates Creek watersheds, upstream of the Utopia and New Lowell reservoirs respectively.
- m. To protect the highly erosive banks along the lower reaches of the Nottawasaga River, it is recommended that the Authority recommend immediately to the Federal Government that suitable speed and wake limits for power-driven vessels be established at Wasaga Beach under the provisions of the Boating Restriction Regulations.

Speed limits should be designed to restrict waves created by the boats to not more than 8 inches above the surface of the water when calm.

APPENDIX A – FLOOD PLAIN MAPPING

As discussed in Chapter 4, Section 3 of this report, flood plain mapping, combined with fill and construction regulations, can minimize damage from flooding.

Mapping will also serve to identify areas where high water levels can be expected, and will therefore increase the effectiveness of flood warning systems and permit early alerting of residents to dangers from rising waters.

To register and administer flood plain regulations, the Authority should have the boundaries of areas vulnerable to flooding clearly marked on maps, plans or aerial photographs.

There are a number of methods by which the limits of the flood plain may be determined. However, in all cases, these limits should be based on flows resulting from the Regional Storm occurring over the watershed above the area under study.

The Regional Storm for the Nottawasaga Valley and the surrounding area is the twelve-hour rainstorm which was the cause of severe flooding at Timmins in 1961.

For the purpose of flood plain regulations, the regional storm for this area is defined as follows:

“Regional storm” means a storm producing, in a twelve-hour period, in a drainage area of, Ten square miles or less, a rainfall that has the distribution set out in Table A-1, or more than ten square miles, a rainfall such that the number of inches of rain referred to in each case in Table A-1 shall be modified by the percentage amount shown in Column 2 of Table A-2 opposite the size of the drainage area set out opposite thereto in Column 1 of Table A-2.

In this analysis, the U.S. Soil Conservation Service hydrograph method was used to determine the storm pattern transposed to each watershed and the resultant flows. The peak flows obtained were used to determine the level of water under these flood conditions.

Utilizing the collected field data, which includes measurements of existing bridges and culverts, surveys of river valleys and evaluation of the ability of river channels and valleys to convey the flows, a flood water surface profile was prepared using the IBM 360 electronic computer. The computed water surface elevations were then plotted directly on aerial photographs, and the limits of the flood plain outlined with the aid of data gathered by field surveys.

This technique was used to prepare flood plain mapping along Innisfil Creek in the vicinity of Highways 89 and 400 in Innisfil Township, Black Ash Creek in Collingwood, and the Pine and Mad Rivers near Angus. The mapped areas are shown on Figures A-1, A-2, A-3 and A-4 respectively.

A summary of the pertinent data for the calculations of the flood water profiles is shown on Table A-3.

Since the calculated flood lines reflect the conditions as they existed at the time of the study, the areas should be re-examined from time to time, and the flood lines revised if any changes have occurred that would affect the design flows or the capacity of the channels.

As the photo mosaics used for the mapping were of the uncontrolled type, field surveys would be necessary to determine the exact location of the flood line on individual properties.

TABLE A-1

0.6 inches of rain in the first hour
0.8 inches of rain in the second hour
0.4 inches of rain in the third hour
0.1 inches of rain in the fourth hour
0.2 inches of rain in the fifth hour
0.8 inches of rain in the sixth hour
1.7 inches of rain in the seventh hour
0.8 inches of rain in the eighth hour
0.9 inches of rain in the ninth hour
0.5 inches of rain in the tenth hour
0.5 inches of rain in the eleventh hour
0.3 inches of rain in the twelfth hour

TABLE A-2

Column 1	Column 2
Drainage Area (Square Miles)	Percentage
11 to 20 both inclusive	97
21 to 30 both inclusive	94
31 to 40 both inclusive	90
41 to 60 both inclusive	87
61 to 80 both inclusive	84
81 to 100 both inclusive	82
101 to 150 both inclusive	79
151 to 200 both inclusive	76
201 to 300 both inclusive	74
301 to 400 both inclusive	70
401 to 500 both inclusive	68
501 to 600 both inclusive	66
601 to 700 both inclusive	65
701 to 800 both inclusive	64
801 to 900 both inclusive	63
901 to 1000 both inclusive	62
1001 to 1500 both inclusive	58
1501 to 2000 both inclusive	56
2001 to 2500 both inclusive	53
2501 to 3000 both inclusive	50

TABLE A - 3
HYDROLOGIC DATA USED FOR FLOOD PLAIN MAPPING

Stream	Drainage Area Above Site	Maximum 12 hr. Rainfall	Peak Flow CFS*	Peak Flow CSM**
Black Ash Creek at Collingwood	6.77	7.6 inches	1950	278.2
Innisfil Creek at Highway 89	27.25	7.0 inches	2530	92.9
Pine River at Angus	134.3	5.95 inches	9130	68.0
Mad River at Angus	155.0	5.85 inches	10200	65.8

*CFS: Cubic feet per second

**CSM: Cubic feet per second per square mile of drainage area



FLOOD PLAIN
OF
INNISFIL CREEK
(NEAR COOKSTOWN)

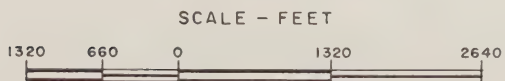


FIG. A-1



FLOOD PLAIN
OF THE
BLACK ASH CREEK
IN COLLINGWOOD

SCALE — 1" = 1320'
(APPROXIMATE)

FIG. A-2



FLOOD PLAIN
OF THE
PINE RIVER
AT ANGUS

SCALE — 1" = 1320'
(APPROXIMATE)

FIG. A-3



FLOOD PLAIN
OF THE
MAD RIVER
AT ANGUS

SCALE - 1" = 1320'
(APPROXIMATE)

FIG. A-4

APPENDIX B – RESERVOIR INVESTIGATIONS

Reservoirs are almost always of dual or multi-purpose type. For this reason, cross-disciplinary considerations are included in preliminary investigations for selection of reservoir sites and the purposes they serve.

The main consideration in the selection of reservoir sites is flood protection. For this purpose alone and for ease of operation, one or two large reservoirs on the Nottawasaga River would have been ideal. No large reservoir sites were found with potential for sufficient storage for flood protection.

A number of smaller flood detention reservoir sites were also investigated along the major tributaries. This alternative approach was based on the premise that a series of smaller upstream reservoirs could be established over a period of time to ultimately afford a wide variety of conservation benefits.

Some added advantages over large reservoir sites are as follows. There would be less likelihood of conflict between prospective users of the impounded or released water. More flexibility would be possible in the operation of dams. The wider distribution of smaller reservoir sites over tributaries of the Nottawasaga River has advantages for recreation. Small reservoirs considered together are also of greater direct value to migratory wildlife than would be a single large reservoir.¹

The potential dam and reservoir sites examined during the watershed survey are summarized in Table B-1. As previously mentioned, the investigations could be only preliminary at this stage. As well, no sub-surface investigations were undertaken or proper cost estimates made.

Keenansville Reservoir

This reservoir would be located in Lot 13, Concession VII, Adjala Township and would be used to control Bailey Creek. Available data indicated that a storage reservoir could provide much needed flow augmentation during low flow periods and limited flood protection. A dam 29 feet high and 960 feet long would provide a pond with a storage capacity of 860 acre-feet. This reservoir would store about 1 inch of the run-off from the drainage area.

Maple Valley Reservoir

This site is in Lot 32, Concession II, Melancthon Township, a short distance upstream from an existing small dam on the Noisy River. The reservoir would have a maximum potential storage of approximately 4000 acre-feet, which would correspond to about 3.5 inches of the run-off from the drainage area above it. With a proper control structure, it could also provide a constant flow of cool water during the summer months which would be beneficial to game fish.

Singhampton Reservoir

This site is located on the Niagara Escarpment, in Lot 9, Concession VIII, Osprey Township, a short distance upstream from Highway 24 at Singhampton. The maximum available storage was estimated to be approximately 3800 acre-feet, the equivalent run-off of slightly over 3 inches from the drainage area above it.

Everett Reservoir

This site, in Lot 13, Concession IV, Tosorontio Township, did not prove to have sufficient extra potential storage capacity. The Pine River has 73.3 square miles of drainage area above this reservoir, and the volume of floodwaters stored would be negligible.

¹ Luna B. Leopold, Thomas Maddoch: The flood control controversy.

TABLE B - 1
SUMMARY OF INVESTIGATED RESERVOIR SITES

Location of Reservoir	River	Drainage Area Sq. Miles	Storage Capacity - Ac. ft. *	Maximum W.L.	Dam Height Ft.	Dam Length Ft.	Possible Purpose
Keenansville	Bailey Creek	18.5	860*	792.0	29.0	960	Flood control, low flow and irrigation
Maple Valley	Noisy River	21.6	4,000*	1,630.0	35.0	555	Flood control and low flow
Newton Robinson	Pennville Creek	17.0	430*	723.0	19.0	400	Irrigation
Everett	Pine River	73.3	640*	775.0	24.0	850	Recreation
Singhamppton	Mad River	23.5	3,800*	1,630.0*	30.0*	1,400*	Flood control

*Taken from 1:50,000 topographic maps and of limited accuracy.

Newton Robinson Reservoir

The Pennville Creek has approximately 17 square miles of its drainage basin above this reservoir. The limiting factor in the site's usefulness is the topography which allows only a dam of low height.

The reservoir could add to recreational or irrigation opportunities, but cannot be assessed other than on a low order of priority.

The three reservoir sites recommended for further investigation — Keenansville, Maple Valley and Singhampton — would provide a possible total storage of 8660 acre-feet.

